



# ***CellPath*<sup>™</sup> 90 ATM T1 WAN Multiplexer User's Manual**

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NOTE: The *CellPath*<sup>™</sup> 90 has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of the equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

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The following instructions are provided to ensure compliance with the Federal Communications Commission (FCC) Rules, Part 68.

- (1) This device must only be connected to the T1 network connected behind an FCC Part 68 registered channel service unit. Direct connection is not allowed.
- (2) Before connecting your unit, you must inform the telephone company of the following information:

SOC	FIC	Manufacturers Port Identifier
6.0N	04DU9-1SN	RJ48C

- (3) If the unit appears to be malfunctioning, it should be disconnected from the telephone lines until you learn if your equipment or the telephone line is the source of the trouble. If your equipment needs repair, it should not be reconnected until it is repaired.
- (4) If the telephone company finds that this equipment is exceeding tolerable parameters, the telephone company can temporarily disconnect service, although they will attempt to give you advance notice if possible.
- (5) Under the FCC Rules, no customer is authorized to repair this equipment. This restriction applies regardless of whether the equipment is in or out of warranty.
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- EN 50082-1 - "Electromagnetic compatibility - Generic immunity standard Part 1: Residential, commercial, and light industry."
- IEC 1000-4-2 - "Electromagnetic compatibility for industrial-process measurement and control equipment Part 2: Electrostatic discharge requirements."
- IEC 1000-4-3 - "Electromagnetic compatibility for industrial-process measurement and control equipment Part 3: Radiate electromagnetic field requirements."
- IEC 1000-4-4 - "Electromagnetic compatibility for industrial-process measurement and control equipment Part 4: Electrical fast transient/burst requirements."

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# Preface

The intent of this manual is to supply users of the *CellPath*<sup>™</sup> 90 ATM T1 WAN Multiplexer with all the necessary information to install, configure, and run the *CellPath* 90 successfully. This document provides general product information, network configuration information, and software administration capabilities. This document was created for users with various levels of experience. If any questions or problems arise with the installation, please contact FORE Systems' Technical Support.

## Chapter Summaries

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**Chapter 1. Introduction** - Describes how to use this guide, the organization of major topics, conventions used and FORE Systems, Inc. warranty and support policy.

**Chapter 2. Product Description** - Describes the *CellPath* 90, its features, and benefits.

**Chapter 3. Installation** - Provides information on installing the *CellPath* 90. Information concerning power connections as well as the various types of interface types are provided.

**Chapter 4. System Configuration** - Describes the *CellPath* 90 factory settings and provides information on the User Interface to change these settings to fit the users specific requirements. The various configuration menus and screens are explained in detail.

**Appendix A - Specifications** - Provides hardware, environmental, and general operating specifications for the *CellPath* 90.

**Appendix B - Additional Configuration Information** - Provides additional information to assist in configuring the *CellPath* 90.

**Appendix C - Converting DFAs or DLCIs and VPI.VCIs** - Describes the correlation between ATM DXI, Frame Relay, and ATM UNI connection identifiers. Provides information on the various header types of each protocol and Frame Relay/ATM DXI 2-byte header to VPI/VCI conversion table.

**Appendix D - Connector Pinouts** - Provides pinouts of the various interfaces found on the rear panel of the *Cellpath* 90.

**Appendix E - Configuration Worksheets** - Provides a set of worksheets that can be copied and filed out prior to configuring the *CellPath* 90. These worksheets can be an aid in gathering information needed to properly configure the *CellPath* 90.

**Acronyms** - A list of common networking acronyms is provided.

**Glossary** - A glossary is provided to describe the many acronyms and terms used throughout this manual.

## **Technical Support**

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In the U.S.A., contact FORE Systems' Technical Support by any one of three methods:

1. If Internet access is available, contact FORE Systems' Technical Support via eMail at the following address:

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2. FAX questions to "support" at:

**412-742-7900**

3. Send questions, via U.S. Mail, to the following address:

**FORE Systems, Inc.  
1000 FORE Drive  
Warrendale, PA 15086-7502**

4. Telephone questions to "support" at:

**1(800)671-FORE (3673)**

**or**

**1(412)635-3700**

Technical support for non-U.S.A. customers should be handled through local distributors.

No matter which method is used for technical support, please be prepared to provide the serial number(s) of the product(s) and as much information as possible describing the problem/question.

## Typographical Styles

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Throughout this manual, specific commands to be entered by the user appear on a separate line in bold typeface. In addition, use of the Enter or Return key is represented as <Enter>. The following example demonstrates this convention:

```
cd priv/releae/sunny<Enter>
```

Commands or file names that appear within the text of this manual are represented in the following style:

```
"Rewrite running code to nonvolatile storage"
```

## Important Information Indicators

---

To call attention to safety and otherwise important information that must be reviewed to insure correct and complete installation, as well as to avoid damage to the system, FORE Systems utilizes the following **WARNING/CAUTION/NOTE** indicators.

**WARNING** statements contain information that is critical to the safety of the operator and/or the system. Do not proceed beyond a **WARNING** statement until the indicated conditions are fully understood or met. This information could prevent serious damage to the operator, the system, or currently loaded software, and are indicated as:

### **WARNING!**



Hazardous voltages are present. To lessen the risk of electrical shock and danger to personal health, follow the instructions carefully.

Information contained in **CAUTION** statements is important for proper installation/operation. **CAUTION** statements can prevent possible equipment damage and/or loss of data and are indicated as:

### **CAUTION**



Risk of damaging the equipment and/or software could occur if the following instructions are not followed.

Information contained in **NOTE** statements has been found important enough to be called to the special attention of the operator and are set off from the text as follows:



Steps 1, 3, and 5 are similar to the installation for the computer type above. Review the previous installation procedure before installing this particular model.

## Safety Agency Compliance

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This preface provides safety precautions to follow when installing a FORE Systems, Inc., product.

### Safety Precautions

For personnel protection, observe the following safety precautions when setting up the equipment:

- Follow all warnings and instructions marked on the equipment.
- Ensure that the voltage and frequency of the power source matches the voltage and frequency inscribed on the equipment's electrical rating label.
- Never push objects of any kind through openings in the equipment. Dangerous voltages may be present. Conductive foreign objects could produce a short circuit that could cause fire, electric shock, or damage to the equipment.

### Symbols

The following symbols appear in this book.

**CAUTION**



If instructions are not followed, there is a risk of damage to the equipment.

**WARNING!**

Hazardous voltages are present. If the instructions are not heeded, there is a risk of electrical shock and danger to personal health.

## Modifications to Equipment

Do not make mechanical or electrical modifications to the equipment. FORE Systems, Inc., is not responsible for regulatory compliance of a modified FORE product.

## Placement of a FORE Systems Product

**CAUTION**

To ensure reliable operation of FORE Systems products and to protect it from overheating, openings in the equipment must not be blocked or covered. A FORE Systems product should never be placed near a radiator or heat register.

## Power Cord Connection

**WARNING!**

FORE Systems products are designed to work with single-phase power systems having a grounded neutral conductor. To reduce the risk of electrical shock, do not plug FORE Systems products into any other type of power system. Contact local facilities personnel or a qualified electrician if unsure of the what type of power supplied to the building.

**WARNING!**

FORE Systems products are shipped with a grounding type (3-wire) power cord. To reduce the risk of electric shock, always plug the cord into a grounded power outlet.

## *Preface*

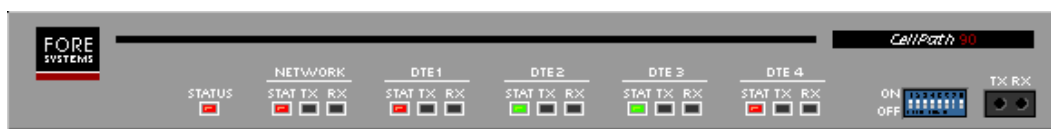
# CHAPTER 1

## Introduction

ATM is a networking technology which has been adopted by telephone companies, private network providers, and datacom and telecom equipment manufacturers as the technology for voice, video, image and data communications for both local and wide area networks. The ATM Forum and ITU-T (CCITT) are two standards bodies developing and ratifying standards for ATM technology. Each body tracks the other very closely. FORE Systems, Inc. has incorporated applicable ATM, as well as other networking standards, into the *CellPath 90* ATM T1 WAN Multiplexer.

### 1.1 *CellPath 90* ATM T1 WAN Multiplexer

The *CellPath 90* ATM T1 WAN Multiplexer (Figure 1.1) is a small profile, CSU-like product that supports from two to four applications ports and one ATM T1 network port. The application ports include two serial RS-530/V.35/X.21 interfaces, one channelized T1 interface and an Ethernet port.



**Figure 1.1 - *CellPath 90* ATM T1 WAN Multiplexer**

The *CellPath 90* supports three networking services: data interworking, Ethernet bridging and circuit emulation.

Data interworking is used to support frame-based data applications such as Frame Relay and ATM DXI. These applications are bursty in nature and can tolerate variable transmission delays. Data interworking is implemented by mapping link layer frames to ATM PVCs configured for Variable Bit Rate (VBR) Quality of Service (QoS). The *CellPath 90* supports data interworking on its serial ports for devices that support ATM DXI, Frame Relay or HDLC-based link protocols.

The *CellPath* 90 also supports remote bridging on its Ethernet port. This feature enables users to connect Ethernet segments directly to the *CellPath* 90 for connectivity to other locations. The *CellPath* 90 implements a learning bridge function and maps forwarded MAC frames to PVCs configured for VBR QoS. The forwarded frames are encapsulated in accordance with RFC-1483 for bridged Ethernet protocol data units (PDUs).

The *CellPath* 90 supports Circuit Emulation Services (CES) in accordance to ATM Forum Interoperability Specification 94-0033R8. Circuit emulation provides a virtual private line connection to the attached application. This service is used to support applications that require a fixed delay transmission path that preserves the bit integrity of the application's transmitted data. Examples of applications that requires circuit emulation service include PBX trunking and H.320 video conferencing

Circuit emulation is implemented by mapping application traffic to ATM PVCs configured for Constant Bit Rate (CBR) QoS. The *Cellpath* 90 supports circuit emulation service (CES) on its Structured DSX-1 port and its serial ports.

The *CellPath* 90 is one rack-unit high and is rack mountable in either a standard 19" (48.26cm) or 23" (58.42 cm) rack.

The *CellPath* 90 aggregates user traffic from existing applications, including CSU and Frame Relay DTE onto a single T1 ATM network. It can accommodate Ethernet, voice, video, data and image simultaneously. It supports PBX tie trunks, host to host communication and video conferencing equipment to facilitate multi-media networking between high-speed devices such as workstations, computers, and routers at T1 speeds.

## 1.2 Functional Description

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A functional block diagram of the *CellPath* 90 is shown in Figure 1.2. The main board consists of two V.35/RS449/X.21 serial ports (DTE 1 and DTE 2), a 100 $\Omega$  T1 ATM port, an external clock (EXT CLK) connections, and a RS-232 Network Management Station (NMS) serial port. Adding the optional daughter board supplies the *CellPath* 90 with two additional DTE ports (DTE3 ETHERNET and DTE4 T1 ).

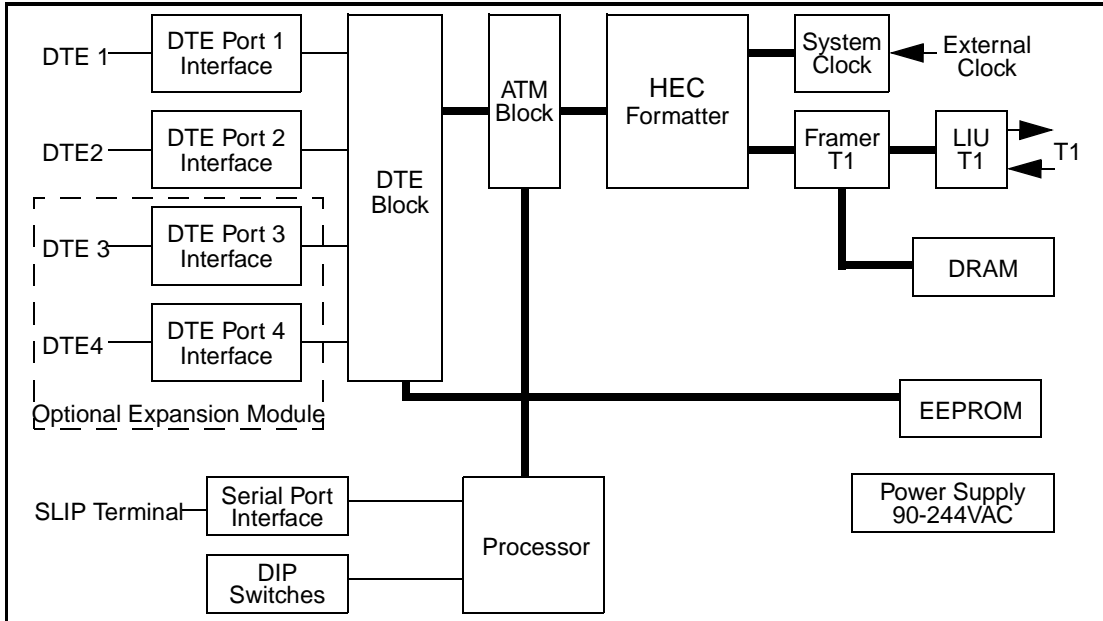


Figure 1.2 - Functional Block Diagram

## 1.3 Features

### 1.3.1 Circuit Emulation Services

Circuit Emulation Services (CES) are supported for applications that require fixed delay, loss-less end-to-end connection through the network. In essence, circuit emulation provides virtual private line service to the connecting application. The *CellPath 90* implements ATM Adaptation Layer 1 (AAL1) in accordance with ATM Forum Circuit Emulation Interoperability Specification 94-0033R8. Adapted traffic is transmitted through the network over Constant Bit Rate (CBR) Permanent Virtual Circuits (PVCs). Examples of applications that require this type of ATM network service are circuit-based video-conferencing connections, PBX inter-machine trunks and WAN multiplexer connections.

The Circuit Emulation Interoperability Specification identifies several types of circuit emulation. The two fundamental types are Structured DS1/T1 Nx64 kbit/s (Fractional DS1/T1) and Unstructured DS1/T1 (1.544) service. The *CellPath* 90 supports structured DS1/T1 Nx64 kbit/s CES on the T1 DTE port. Table 1.1 provides a matrix of port-to-port connection types supported on FORE's various circuit emulation products. Entries are formatted as:

- Mode:  
S: structured circuit emulation  
U: unstructured circuit emulation
- Number of connections:  
Maximum number of connections per T1 port
- Connection Bandwidth:  
Nx56/64: Nx56/64 kbps  
Nx64: Nx64 kbps  
DS1: 1.544 Mbps

**Table 1.1 - *CellPath* 90 Circuit Emulation Interoperability Matrix**

		VoicePlus	CellPath 90		CellPath 300	
		T1 Ports	T1 Ports	Serial Ports	T1 Ports	Serial Ports
VoicePlus	T1 Ports	S: 24: Nx64; U:1:DS1	S: 6: Nx64	S: 24: Nx64	U: 1: DS1	X
CellPath 90	T1 Ports	S: 6: Nx64	S: 6: Nx64	S: 6: Nx64	X	X
	Serial Ports	S: 24: Nx64	S: 6: Nx64	S: 1: Nx64; U: 1: Nx56/64	U: 1: Nx56/64	U: 1: Nx64
CellPath 300	T1 Ports	U: 1: DS1	X	U: 1: Nx64	U: 1: DS1	U: 1: Nx64
	Serial Ports	X	X	U: 1: Nx64	U: 1: Nx64	U: 1: Nx64

### 1.3.1.1 Structured CES

Structured DS1/T1 Nx64 kbit/s service specifies a method for providing CES for (N) 64 kbit/s timeslots contained within a channelized DS1/T1 signal. There are several modes of operation defined within this class of CES. In particular, DS1/T1 Nx64 Service with Channel Associated Signaling (CAS) is the mode in which voice channels and associated CAS bits are encapsulated for transport through the network.

### 1.3.1.2 Mapping of Bundles

The *CellPath* 90 has the ability to map bundles of T1 56Kbps and 64Kbps channels to ATM virtual channels. This feature provides up to 6 unique ATM connections which can be mapped to any of the DS0s in the fractional T1 interface allowing the user to connect a PBX, or other Fractional T1 device, to up to 6 different sites.

## 1.3.2 Voice

Voice traffic is supported as AAL1 via the optional DSX-1 (DTE T1) interface on the *CellPath* 90. If planning to transmit voice over an ATM network, it is recommended that the DSX-1 interface be ordered with the *CellPath* 90. This interface supports structured mode for Nx56 or Nx64 where  $N \leq 24$ . Due to ATM overhead, the maximum number of configurable channels is 20.

### Video

The V.35/RS449/X.21 ports support Nx64 data for  $N \leq 24$  and can be configured to support video-conferencing using the smooth clock. Due to ATM overhead, the maximum number of configurable channels is 20. Video frames are segmented in accordance with AAL1 for transmission to the ATM network. When receiving ATM cells from the network, the *CellPath* 90 reassembles the encapsulated video frames for transmission to the video codec.

Additionally, the *CellPath* 90 provides the option of applying the specified signalling pattern towards the DTE connected (e.g., PBX) in the event of a fault condition at the ATM network port. The DTE4 Configuration screen in the user interface (UI) contains settings for on-hook and off-hook values. These settings should be configured to match those of the connected system.

## 1.3.3 Data Protocols

The *CellPath* 90 supports ATM DXI Mode 1a (Frame Relay), Structured AAL1 V.35 CBR (no signalling), Transparent (Unstructured) AAL1 CBR, and Raw High-level Data Link Control (HDLC) protocols on the V.35/RS449/X.21 serial ports. The serial ports provide both continuous and gapped clock selections. DTE data packets can be programmed to be formatted as ATM Adaptation Layer 5 (AAL5). In addition, the Frame Relay Data Link Connection Identifier (DLCI) is directly mapped into the appropriate Virtual Path Identifier/Virtual Channel Identifier (VPI/VCI) per ATM DXI specifications. The ATM Configuration screen, in the user interface (UI), allows either default VPI.VCI-to-DLCA/DFA mapping of connections, or in the case of Frame Relay, selectively setting the DLCA/DFA to a specific value.

### 1.3.3.1 ATM DXI Mode 1a

The *CellPath* 90 supports ATM DXI Mode 1a in accordance with ATM Forum ATM Data eXchange Interface (DXI) Specification, Version 1.0, August 1993. The *CellPath* 90 supports up to 15 Virtual Path Connections (16 VPI values minus VPI 0); and up to 256 Virtual Channel Connections using combinations of the 16 VPI values and the 32 available VCI values (32 of the total 64 values are reserved).

### 1.3.3.2 Frame Relay

The *CellPath* 90 supports Frame Relay to ATM Service Interworking in accordance with Frame Relay Forum Service Interworking Agreement FRF.8. The service interworking function (IWF) does not transport traffic transparently, but instead functions more like a protocol converter facilitating communication between dissimilar frame relay and ATM equipment. Frame relay traffic is sent on a PVC through the frame relay network to the Service IWF which then maps it to an ATM PVC. The frame relay PVC address-to-ATM PVC address mapping, and other servicing options, are configured by the network management system associated with the IWF.

Due to architectural differences between frame relay and ATM, Service IWF converts header function mapping and multiprotocol data unit headers from frame relay formats to ATM formats and vice versa.

### 1.3.3.3 Structured/Unstructured AAL1

Both structured and unstructured AAL1 services are supported on the DTE1 and DTE2 serial ports. Structured mode allows connectivity to a channelized T1 port at the other end of the connection. On the serial ports, the *CellPath* 90 supports Nx56/64 kbps circuit emulation.

### 1.3.3.4 Raw HDLC

Raw HDLC allows the transportation of HDLC based frames over ATM. With this mode enabled, a DTE port may be configured to the CEX/HDLC mode. All HDLC packets received from this port are converted with the following method:

- Verify the CRC in the packet.
- Remove the flag and CRC from the HDLC frames and encapsulate them into AAL5 frames for transport.
- A dedicated ATM address is used for HDLC frames received at the DTE port.
- AAL5 frames, at the receiving end, are reformed into HDLC frames, the flag and CRC are inserted and retransmitted over the designated DTE port.

### 1.3.4 LAN Connectivity

The *CellPath 90* provides MAC layer bridging connectivity between an Ethernet Local Area Network (LAN) and the ATM network. Ethernet frames are filtered and segmented using AAL5 for transmission to the ATM network. When ATM cells are received from the network, the Ethernet frames are reassembled from the cells, and frames are transmitted to the LAN.

### 1.3.5 Management

The *CellPath 90* provides a native (built-in) Simple Network Management Protocol (SNMP) agent and incorporates RFC-1406 DS-1/T1 Management Information Base (MIB) as well as an Enterprise MIB. The *CellPath 90* can be managed using SNMP, through a direct connection of a VT100 (ANSI) terminal, an SNMP Manager to its RS232C NMS port or through a Telnet, Ethernet, or ATM session.

#### 1.3.5.1 SNMP Over Ethernet

SNMP packets are captured in the segmentation/reassembly handler on the designated VPI/VPC. These messages are then sent to the internet protocol (IP) task.

#### 1.3.5.2 SNMP Over ATM

Both SNMP and the Interim Local Management Interface (ILMI) handler use the SNMP agent to process messages. The SNMP interface layer collects the message packets from the User Datagram Protocol (UDP) and ILMI passes them on to the SNMP agent.

#### 1.3.5.3 Interim Local Management Interface (ILMI)

ILMI is provided to allow network devices to interrogate the *Cellpath 90* through the network connection. With the ILMI feature enabled, ILMI initially contains a default ATM VPI.VCI of 0.16. ATM packets received from the network interface are scanned for an ILMI address. Upon identifying the packets, they are routed directly to the appropriate SNMP task for processing.

#### 1.3.5.4 Telnet

The *CellPath 90* can support one Telnet session per unit. Additional requests for Telnet sessions are denied until the current session is released. The Telnet daemon connects to a second instance of the menu task. The exact functionality of the current menu interface is supported by the Telnet session.

### 1.3.6 Diagnostics

The *CellPath 90* provides performance monitoring and fault management diagnostic support. Troubleshooting is easy with its capability to generate, transmit and receive test packets and ATM cells. A variety of loopbacks (DTE and Network) are provided for fault isolation.

### 1.3.7 Downloadable Software

The ability to download software makes it easy to upgrade the *CellPath 90* with new features and functions. Both the software and configuration of the *CellPath 90* are saved in EEPROM. The *CellPath 90* can be upgraded locally through the RS232C (NMS) port or through the use of the trivial file transport protocol (TFTP).

One TFTP session is supported per unit. When TFTP is initiated, the unit erases the program FLASH and begins the download process. If the download fails due to a TFTP timeout or error, the FLASH memory is erased and reprogrammed with the current running code. If the download is successful, the unit resets and starts running the new code.

### 1.3.8 Storage and Retrieval via TFTP

The *CellPath 90* supports TFTP storage and retrieval of the unit configuration database. The user can open a TFTP session with the *CellPath 90* and execute a 'get' to retrieve the configuration database, and conversely, by executing a 'put' be able to restore the *Cellpath 90* configuration.

### 1.3.9 Virtual Channel Connection (VCC) Support

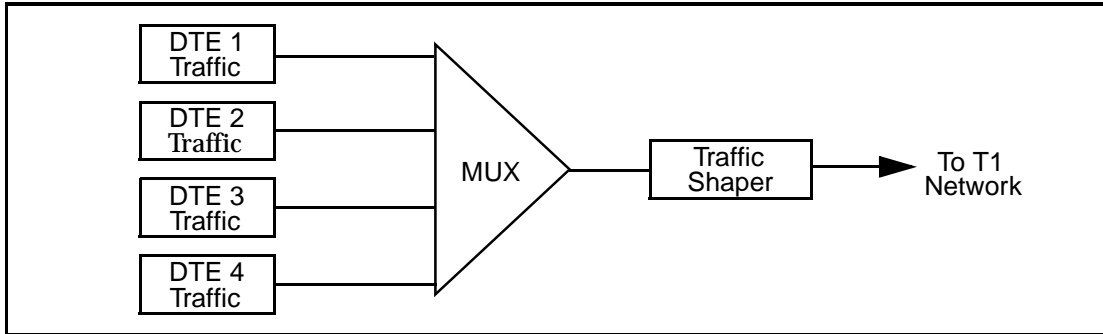
The *CellPath 90* supports up to a maximum of 256 VCCs in aggregate. The serial DTE ports can support 256 VCCs. The Ethernet port can be configured to support up to 8 VCCs for remote bridging, while the structured T1 DTE port can be configured to support up to 6 VCCs for bundled (i.e., fractional) applications.

### 1.3.10 Adaptation Layers

The *CellPath 90* supports ATM Adaptation Layers 1 (AAL1) and 5 (AAL5). For Variable Bit Rate (VBR) devices such as routers, bridges, or channel extenders, AAL5 is used. AAL1 is used for CBR devices such as video codecs, PBXs or channel banks.

### 1.3.11 Traffic Shaping

The network traffic shaping functionality provides for enforcement of the bandwidth contract. Traffic shaping reduces congestion at the network switch, protects network resources and ensures fair service for all network subscribers. The *CellPath 90* traffic management functionality provides self-policing and ensures fair use of network services. Traffic shaping is performed based on a dual leaky bucket algorithm (see Figure 1.3) for each VPI/VCI connection. Both sustained and peak rates are configurable on a per VPI/VCI basis.



**Figure 1.3 - CellPath 90 Traffic Management Model**

### 1.3.11.1 Peak Cell Rate

The Peak Cell Rate (PCR) traffic parameter specifies an upper bound on the traffic that can be submitted on an ATM connection. The *CellPath 90* supports PCR for both VBR and CBR type traffic.

### 1.3.11.2 Sustainable Cell Rate

The Sustainable Cell Rate (SCR) specifies the conforming average rate of an ATM connection. This field is software configurable by the user on a per VPI/VCI basis for VBR traffic only.

## 1.3.12 ATM T1 Network

The *CellPath 90* ATM T1 network interface operates at 1.544 Mbps and appears at a female DB15 interface on the back of the unit. This interface includes an on-board Extended Super-frame (ESF) Channel Service Unit (CSU) that conforms to ANSI and AT&T standards for ESF CSU equipment. The ATM T1 network interface conforms to the ATM Forum 3.1 and ITU-T G.804 standards for Header Error Control (HEC) cell delineation. Cell delineation is the method used by an ATM interface for achieving proper cell alignment on the incoming ATM cell stream.

The available payload bandwidth on the ATM T1, after cell overhead and framing overhead are deducted, is 1.36 Mbps.

### 1.3.12.1 Cell Mapping & Cell Delineation

Cell mapping on the network interface is based on the ITU-T G.804 Header Error Control (HEC). Cell delineation is the process which allows identification of cell boundaries. The ATM cell header contains a HEC field which is used to achieve cell delineation.

### **1.3.12.2 Scrambling**

Scrambling is provided as a configurable option on the network side and is based on an  $X^{43}+1$  algorithm. Scrambling is used to improve security and robustness of the HEC cell delineation mechanism described above. In addition, it helps randomizing the data in the information field for possible improvement of the transmission performance. The default for T1 is with scrambling on. It may optionally be turned off.

# CHAPTER 2

## Description

This chapter describes the *CellPath* 90 ATM T1 WAN Multiplexer in detail. It starts with the features and functionality of each port. It describes the network management features and finally, reviews system level functions.

### 2.1 DTE Ports

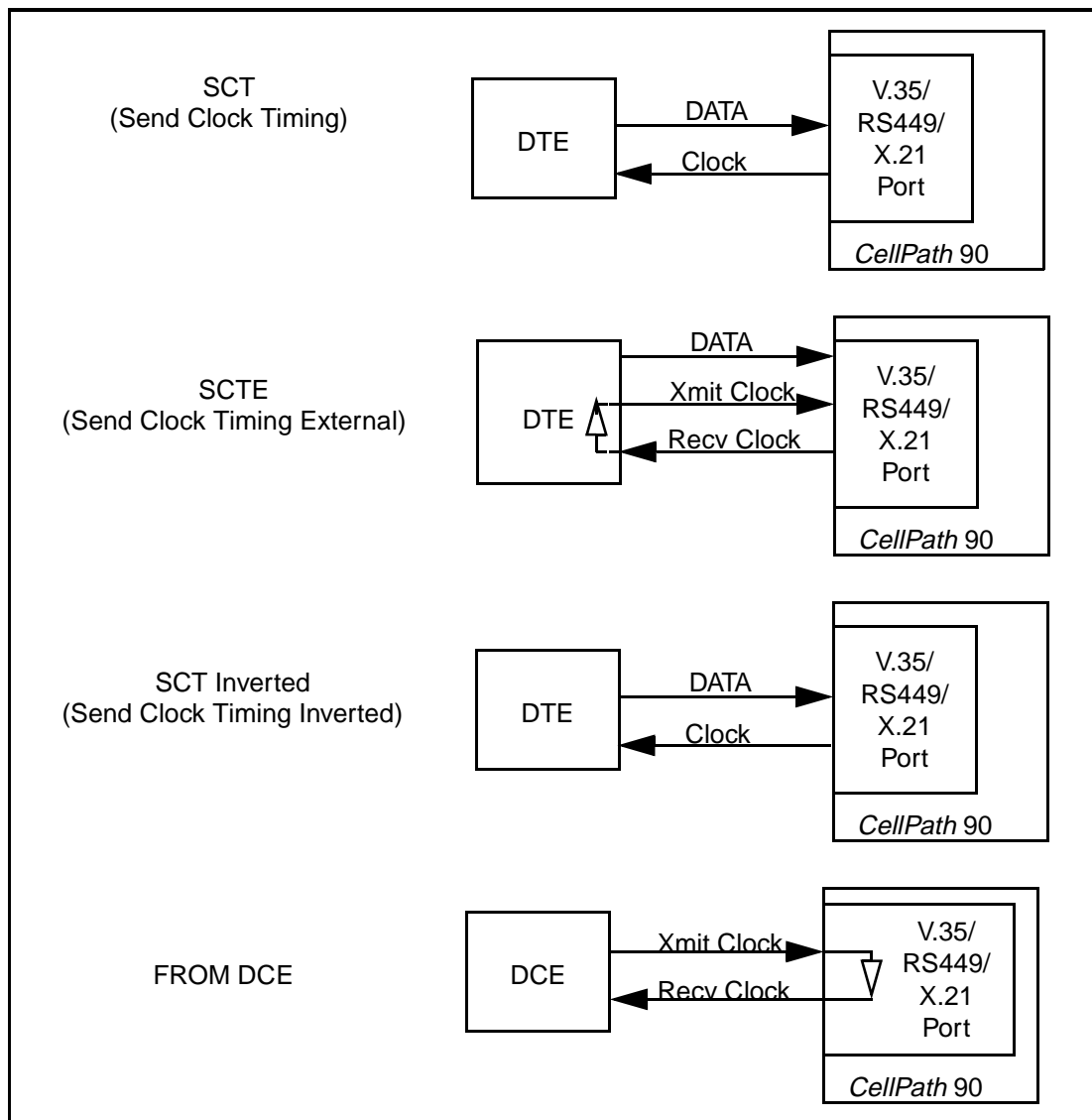
The basic *CellPath* 90 unit provides two V.35/RS449/X.21 ports. Each port is software configurable for Nx56 and Nx64 Kbps data rates. The *CellPath* 90 can be purchased with 4 ports by using the Fractional T1/Ethernet Expansion Module. The module is available as a factory upgrade. Each port is software configurable for Nx56 and Nx64 Kbps data rates for either Variable Bit Rate (VBR) or Constant Bit Rate (CBR) operations. The *CellPath* 90 is designed to allow different protocols to be run on each DTE port simultaneously.

#### 2.1.1 V.35/RS449/X.21 Ports

The V.35/RS449/X.21 ports are fully software configurable. The interface is industry standard EIA530-A, which makes cabling and troubleshooting between the DTE and *CellPath* 90 easy. The list of features supported by this interface are:

<b>Interface Type</b>	The <i>CellPath</i> 90 is equipped with two female DB-25 (EIA530-A) physical connectors. These connectors provide two choices of electrical interface; V.35 and RS449/X.21. Select the interface appropriate to your DTE equipment from the configuration menu of the <i>CellPath</i> 90. DTE equipment, equipped with the standard DB-25 (EIA530-A), can be directly connected to the <i>CellPath</i> 90. DTE equipment, equipped with the standard V.35 connector, can be connected to the <i>CellPath</i> 90 using a DB-25 to V.35 adapter cable and DTE equipment with the standard RS449 connector can use a DB-25 to RS449 adapter cable. Both adapters can be purchased from FORE Systems, Inc. Refer to <i>Appendix D, Connector Pinouts</i> for the appropriate cable/connector pinouts.
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<b>Data Rates</b>	<p>Each DTE port supports Nx56 kbps and Nx64 kbps data rates, where <math>N \leq 24</math>.</p> <p>Due to ATM overhead, the maximum number of configurable channels that can be used for CBR applications is 20. Since sustained rates greater than 24x64 kbps (1536 kbps) are not possible, 20 is the maximum number of channels that can be configured for CBR type traffic.</p>
<b>Clocking Modes</b>	<p>The <i>CellPath</i> 90 is equipped with both smooth (continuous) and gapped clock modes for each DTE interface. It is very important to configure each DTE port for the appropriate clock mode for the type of DTE connected. Constant Bit Rate (CBR) DTE, such as video conferencing systems, require a continuous clock. Also, ensure that the control leads (RTS &amp; CTS) are enabled for flow control for the port requiring a continuous clock. Variable Bit Rate (VBR) equipment, such as routers, can function normally with the gapped clock selection. If the DTE continuously sends packets, frame memory fills and frames may be dropped if gapped clock is not selected.</p>
<b>Clocking</b>	<p>The <i>CellPath</i> 90 interface is EIA530-A DCE. The clocking options available support Send Clock Timing (SCT), Send Clock Timing External (SCTE), Send Clock Timing Inverted (SCT Inverted), and FROM DCE. Refer to Figure 2.1 for a representation of each timing option.</p> <p>SCT uses the internal Stratum 4 clock of the <i>CellPath</i> 90.</p> <p>SCTE uses an external clock provided by the end point.</p> <p>SCT Inverted uses the internal Stratum 4 clock with a phase shift inserted.</p> <p>FROM DCE uses a clock provided by a remote device. When the DTE1 or DTE2 port is configured as a DTE interface, a special cable is required to interface to DCE equipment. When using this timing option, the <i>CellPath</i> 90 passes the received clock out the transmit port with the data.</p>
<b>Data Type</b>	<p>Each of the V.35/RS449/X.21 ports are configurable for both CBR or VBR applications.</p>

**Figure 2.1 - CellPath 90 Timing Options**

<b>Protocol</b>	The <i>CellPath</i> 90 supports: ATM DXI (Frame relay, 2-byte header, CRC-16); Structured AAL1 CBR (no signaling); Unstructured AAL1 CBR; Raw HDLC, CRC-16 (CEX Mode); and Raw HDLC, CRC-32 (CEX Mode)
-----------------	--

## 2.1.2 Ethernet - DTE3 Interface

The *CellPath* 90 can function as a remote link protocol MAC-layer bridge. The MAC address transmitted over the ATM network is captured by the *CellPath* 90 and encapsulated per RFC-1483. These packets are segmented into ATM cells, and sent across the ATM network to the destination *CellPath* 90.

*Source Address Validation:* When packets arrive on the Ethernet port, the *CellPath* 90 verifies the source MAC address. If the address is found in the source address table, the packet is sent to the destination validation process. If the polarity of the Ethernet circuit is set to positive the packet is dropped when not found in the MAC table. If polarity is set to negative packets are sent to all connections (i.e., broadcast).

*Destination Validation:* In this step the destination address is mapped to VPI.VCI using the address table.

<b>Interface Type</b>	An AUI interface is provided on the <i>CellPath</i> 90 for connection to an Ethernet LAN. A transceiver is required on this port to interface with Thin Net or 10 Base-T.
-----------------------	---

## 2.1.3 T1 - DTE4 Interface

The T1 DTE interface is a fractional T1 interface which can be used to send voice or data traffic over an ATM network. Due to ATM overhead a maximum of 20 channels can be transmitted over the ATM network.

<b>Interface</b>	The electrical interface to your PBX or Channel Bank is T1.
<b>Receive Attenuation</b>	Receive attenuation is less than 10dB.
<b>Equalizer Setting</b>	The T1 DTE interface provides automatic equalization for distances up to 655 feet.
<b>Channel Usage</b>	Any 20 channels of the 24 channels may be utilized. The rest of the bandwidth is allocated to ATM overhead. Each of the 20 channels can be configured to send either voice or data.

### 2.1.4 Network Interface (T1)

The *CellPath* 90 provides full T1 functionality, including Loopbacks, Alarms and Statistics.

Electrical	The network interface provides CSU functionality and complies with ANSI T1.403.
Receive Attenuation	The <i>CellPath</i> 90 has receive sensitivity from 0 to 36 dB which enables it to receive signals from an T1 repeater as far as 6000 feet (1828 meters).
LBO Setting	Line Build Out (LBO) can be set to 0 dB, -7.5 dB, -15 dB, or -22.5 dB from the configuration menu.
Jitter / Wander	The T1 network interface meets jitter and wander requirements per AT&T PUB 62411.
Transmit Synchronization	Different methods of clocking are supported on the <i>CellPath</i> 90. Typically, the <i>CellPath</i> 90 (in the ATM environment) uses recovered timing from the network for transmitting data to the network. An internal clock (Stratum 4 equivalent) is provided in the event the received clock fails or for back-to-back testing. In addition, an external clock can also be used to operate the <i>CellPath</i> 90. The external clock must be traceable to the network clock in order to run without slips. Clock can also be derived from a T1 DTE interface when the other end of the T1 DTE is connected to the network through a PBX.

Description

## 2.2 External Clock Input

An External Clock input is provided. This interface can support both differential or single ended TTL level signals. The clock must be a continuous 1.544 Mbps with accuracy of  $\pm 50$  ppm.

## 2.3 Network Management

The *CellPath* 90 provides several choices of management interfaces. The Network Management System (NMS) port located on the back panel provides a direct RS232 interface. This port can be configured by using the DIP switches located on the front panel. The NMS (RS232C)

port is protected by password security. A VT100 terminal, or a PC running VT100 Emulation, can be connected to the NMS port for management of the *CellPath* 90. Additionally, an SNMP Manager can be connected to this port.

### **2.3.1 Terminal - VT100**

In terminal mode, the *CellPath* 90 is connected directly to a VT100 (ANSI) terminal. The physical interface is an RS232C DB-9 female connector. Refer to *Appendix D, Connector Pinouts* for the pin-outs of this connector. Dip switches located on the front panel of the unit are used to configure this port

### **2.3.2 SNMP**

The *CellPath* 90 supports the Simple Network Management Protocol (SNMP) with both the standard DS-1 MIB per RFC-1406 and a *CellPath* Enterprise MIB. An SNMP Network Manager can be connected to the RS232C port and communicate with the *CellPath* 90 via SNMP protocol (UDP/IP/SLIP).

#### **2.3.2.1 SNMP Over Ethernet**

SNMP over ethernet is supported through the System Interfaces menu. This menu supports options for a unit IP address, an IP mask, and NMS IP address.

#### **2.3.2.2 SNMP Over ATM**

SNMP over ATM is supported over the serial port. Only one such connection is allowed. Messages are sent directly from the segmentation/reassembly handler. The interface only accepts ARP requests that contains the configured VPI.VCI in the ATM header. All other requests are ignored and discarded. Upon completion of processing of an ARP request, the task sends the response directly to the segmentation/reassembly handler.

### **2.3.3 Interim Local Management Interface (ILMI)**

ILMI is provided to allow network devices to interrogate the *Cellpath* 90 through the network connection. With the ILMI feature enabled, ILMI initially contains a default ATM VPI.VCI of 0.16. This address is configurable and may be changed in the ATM configuration menu. ATM packets received from the network interface are scanned for an ILMI address. Upon identifying the packets, they are routed directly to the SNMP task for processing.

## 2.3.4 Telnet

One Telnet session is supported per unit. Additional requests for Telnet sessions are denied until the current session is released. The Telnet daemon connects to a second instance of the menu task. The same functionality that the current menu supports is also supported by the Telnet session.

## 2.4 Performance Management

### 2.4.1 Network T1 Physical Layer Performance Monitoring

*CellPath* 90 provides Network T1 level performance monitoring on the T1 physical layer. All performance parameters are accumulated in fifteen minute intervals, up to 96 intervals (24 hours worth), and are stored by the agent. Fewer than 96 intervals of data are available if the agent has been restarted within the last 24 hours. In addition, there is a rolling 24-hour total of each performance parameter.

<b>Line Errored Seconds (LES)</b>	Seconds in which one or more Line Code Violation (LCV) error events were detected. Near end LCVs and far end LESs are counted. For consistency, LESs are counted at both ends.
<b>Controlled Slip Seconds (CSS)</b>	A one-second interval containing one or more controlled slips.
<b>Errored Seconds (ES)</b>	Seconds with one or more Path Code Violations (PCV) OR one or more Out Of Frame (OOF) defects OR one or more Controlled Slip (CS) events OR a detected Alarm Indication Signal (AIS) defect. For T1-noCRC links, the presence of Bipolar Violations (BPV) also triggers an ES. ESs are not incremented during Unavailable Second (UAS).
<b>Bursty Errored Seconds (BES)</b>	Seconds with fewer than 320 and more than 1 PCV error events, no Severely Errored Frame (SEF) defects and no detected incoming AIS defects. CSs are not included in this parameter. BESs are not incremented during UAS.
<b>Severely Errored Seconds (SES)</b>	Seconds with 320 or more PCV Error Events OR one or more OOF defects OR a detected AIS defect. For T1-CRC signals, a SES is a second with 832 or more PCV error events or one or more OOF defects. For

	T1-noCRC signals, a SES is a count of one-second intervals with Framing Error events, an OOF defect, or 1544 LVCs or more. CSs are not included in this parameter. SESs are not incremented during UAS.
<b>Severely Errored Framing Second (SEFS)</b>	Seconds with one or more OOF defects OR a detected AIS defect.
<b>Degraded Minutes (DM)</b>	<p>Those minutes in which the estimated error rate exceeds <math>1^{E-6}</math> but does not exceed <math>1^{E-3}</math> (refer to ITU-T G.821).</p> <p>DMs are determined by collecting all of the Available Seconds, removing any SESs, grouping the result in 60-second long groups and counting a 60-second long group (a.k.a., minute) as degraded if the cumulative errors during the seconds present in the group exceed <math>1^{E-6}</math>. Available seconds are merely those seconds which are not unavailable as described below.</p>
<b>Unavailable Seconds (UAS)</b>	<p>Unavailable Seconds (UAS) are calculated by counting the number of seconds for which the interface is unavailable. The T1 interface is said to be unavailable from the onset of 10 contiguous SESs, or on the onset of the condition leading to a failure (see <i>Failure States</i>). If the condition leading to the failure was immediately preceded by one or more contiguous SESs, then the T1 interface unavailability starts from the onset of these SESs. Once unavailable, and if no failure is present, the T1 interface becomes available at the onset of 10 contiguous seconds with no SESs. Once unavailable, and if a failure is present, the T1 interface becomes available at the onset of 10 contiguous seconds with no SESs, if the failure clearing time is less than or equal to 10 seconds. If the failure clearing time is more than 10 seconds, the T1 interface becomes available at the onset of 10 contiguous seconds with no SESs, or the onset period leading to the successful clearing condition, whichever occurs later. With respect to the T1 error counts, all counters are incremented while the T1 interface is deemed available. While the interface is deemed unavailable, the only count that is incremented is UASs.</p>

## 2.4.2 ATM Layer Performance Monitoring

ATM cells are processed at various levels internal to the *CellPath 90*. At the transmission convergence sublayer of the physical layer, ATM cells are delineated from the T1 payload envelope, and the ATM cell header is examined for bit errors as part of a Header Error Control (HEC) algorithm. The *CellPath 90* maintains a count of the following ATM performance parameters:

<b>Received Cells</b>	Count of the total number of valid cells received from the T1 line (ATM network) not including idle cells. These cells can be AAL1 and AAL5 type.
<b>Received Packets</b>	Count of the total number of valid packets received from the T1 line (ATM Network and AAL5 traffic only).
<b>Received Idle Cells</b>	Count of the total number of valid idle cells received from the T1 line (ATM network).
<b>Received HEC Error</b>	Count of the number of HEC violations. This count is suppressed when a physical layer problem occurs.
<b>Received no Match Cells</b>	Counter increments whenever ATM cells are received on a virtual channel (VC) which is not provisioned by the user (unprovisioned VPI.VCI error counts).
<b>Received no Buffer available</b>	Count of errors received due to the lack of available receive data buffers.
<b>Received CRC32 errors</b>	Count of errors received due to reception of an AAL5 packet with a bad CRC32.
<b>Received Abort Cell</b>	Count of AAL5 abort cells received.
<b>Received Packet Aborts</b>	Count of AAL5 packets whose reassembly were aborted due to reassembly timeouts, or reception of abort cells.
<b>Received Packet Length Errors</b>	Count of AAL5 packets whose reassembly were terminated due to the reassembled length not matching the length coded in the packet, or the length simply being too large for the configured DTE protocol.
<b>Received Loss of Cell Delineation</b>	The <i>CellPath 90</i> cell delineation detection circuitry uses the ATM cell HEC to locate the received cells in an T1 payload. When seven cells in a row are discarded due to HEC violations, an out of cell

	delineation occurs, and the RX Loss of Cell Delineation Counter is incremented. This counter is not incremented again until the next out of cell delineation occurs, which occurs only after cell delineation is re-established and then lost again.
<b>Received (SCC TX) RestartTx</b>	Internal diagnostic counter that indicates the number of times the transmit direction of any DTE had to be reinitialized.
<b>Transmit Cells</b>	Count of the total number of transmitted cells to the T1 line (ATM network) not including the idle cells. These cells can be AAL1 and AAL5 type.
<b>Transmit Packets</b>	Count of the total number of transmitted packets to the T1 line (ATM network and AAL5 only).
<b>Transmit Idle Cells</b>	Count of the total number of transmitted idle cells to the T1 line (ATM network).
<b>Number of cells Discarded due to ATM-Layer Header Errors</b>	First the ATM cells are checked for header bit errors and discarded if necessary. Then the idle cells (VPI.VCI = 0.0, CLP=1 or 0) are discarded. The remaining cells are submitted to a series of ATM layer checks. The number of discarded cells due to ATM layer header errors are counted (PTI values '110' and '111'). The counting of ATM cell header processing errors is suspended when physical layer errors occur. However, these counts continue when only ATM layer failures are indicated (for example VP-AIS, VP- RDI).

### 2.4.3 Performance Defects

The following performance defects are detected:

<b>Out Of Frame (OOF) Defect</b>	The occurrence of a particular density of Framing Error events. For T1 links, an OOF defect is declared when three consecutive frame alignment signals have been received with an error. Once an OOF defect is declared, the framer starts searching for a correct framing pattern. The OOF defect ends when the signal is in frame.
----------------------------------	--

**Alarm Indication  
Signal (AIS) Defect**

In-frame occurs when a) in frame N the frame alignment signal is correct and b) in frame N+1 the frame alignment signal is absent (i.e., bit 2 in TS0 is a one) and c) in frame N+2 the frame alignment signal is present and correct.

An Alarm Indication Signal (AIS) Defect is an 'all ones' condition is detected at a T1 line interface upon observing an unframed signal with a one's density of at least 99.9% present for a time equal to or greater than T, where  $3 \text{ ms} \leq T \leq 75 \text{ ms}$ . The AIS is terminated upon observing a signal not meeting the one's density or the unframed signal criteria for a period equal to or greater than T.

## 2.4.4 Failure States

The following failure states are received, or detected, as failures. When a T1 interface would, if ever, produce the conditions leading to the failure state is described in the appropriate specification.

**Far End Alarm Failure**

The Far End Alarm Failure, also known as “Distant Alarm” in the T1 case. For T1 links, the Far End Alarm Failure is declared when bit 3 of time-slot zero is received set to one on two consecutive occasions. The Far End Alarm failure is cleared when bit 3 of time-slot zero is received set to zero.

**Alarm Indication  
Signal (AIS) Failure**

Declared when an AIS defect is detected at the input and the AIS defect still exists after the Loss Of Frame (LOF) failure (which is caused by the unframed nature of the 'all-ones' signal) is declared. The AIS failure is cleared when the LOF failure is cleared.

**Loss Of Frame Failure**

Declared when an OOF defect is detected.

**Loss Of Signal Failure**

Declared when greater than 10 consecutive zeroes are detected.

**Loopback Pseudo-Failure**

Declared when the near end equipment has placed a loopback (of any kind) on the T1. This allows a management entity to determine from one object whether the T1 can be considered to be in service or not (from the point of view of the near end equipment).

## 2.4.5 Error Events

The following error events are reported:

<b>Bipolar Violation (BPV) Error Event</b>	An error event for T1 line code signals when a pulse of the same polarity as the previous pulse occurs without being a part of the zero substitution code.
<b>Excessive Zeros (EXZ) Error Event</b>	An Excessive Zeros (EXZ) error event for an AMI-coded signal is the occurrence of more than fifteen contiguous zeros. For a B8ZS coded signal, the defect occurs when more than seven contiguous zeros are detected.
<b>Line Coding Violation (LCV) Error Event</b>	A Line Coding Violation (LCV) is the occurrence of either a Bipolar Violation (BPV) or Excessive Zeroes (EXZ) Error Event.
<b>Path Coding Violation (PCV) Error Event</b>	A Path Coding Violation (PCV) error event is a frame synchronization bit error (CRC Error).
<b>Controlled Slip (CS) Error Event</b>	A Controlled Slip (CS) is the replication or deletion of the payload bits of an T1 frame. A CS may be performed when there is a difference between the timing of a synchronous receiving terminal and the received signal. A CS does not cause an OOF defect.

## 2.4.6 Loopbacks

The *CellPath 90* provides many different loopbacks options. These loopbacks can be initiated from the Network Manager, Terminal, DTE ports or Network port and are shown in Figure 2.2.

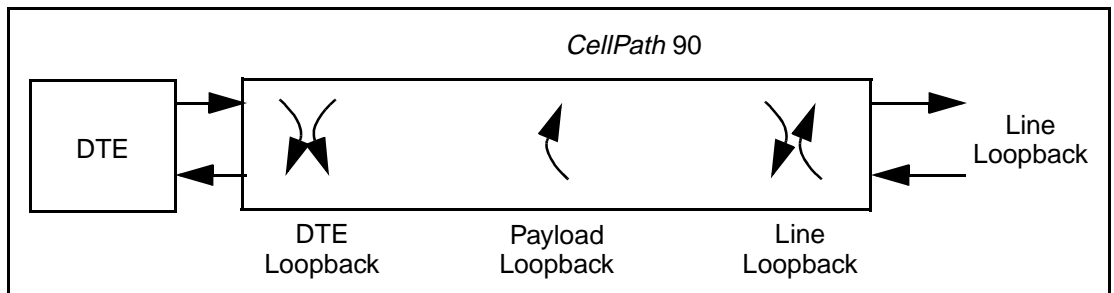


Figure 2.2 - Loopbacks

<b>DTE Loopback</b>	Allows DTE data to be transmitted back to DTE equipment. This is a bidirectional loopback as shown in Figure 2.2. Useful for troubleshooting the cable connections between the DTE equipment and the <i>CellPath 90</i> .
<b>Payload Loopback</b>	Loops the payload data received from the network. Helps to test the front end of the <i>CellPath 90</i> , including clock recovery.
<b>Line Loopback toward DTE</b>	Data received from the DTE equipment travels through the <i>CellPath 90</i> to the line interface and is sent back. Allows testing of the <i>CellPath 90</i> data paths.
<b>Line loopback towards network</b>	Used to troubleshoot cables and repeaters between central office equipment and the <i>CellPath 90</i> .

## 2.4.7 Traffic Generator

A traffic generator is provided to exercise and troubleshoot end-to-end AAL5 CBR connections. The traffic generator is capable of sending packets of any size, within the range of 32 to 9188 bytes, to the remote end unit and any speed from 56 Kbps to full bandwidth (1344 Kb/s).

## 2.5 LED Indicators

The *CellPath 90* is equipped with tri-color LEDs to indicate system operation. Refer to Table 2.1 for a list of system, network, and DTE port alarms.

The overall system LED, labeled STATUS, indicates general system status. Green indicates normal operation, red that a major alarm has occurred, and yellow that a minor alarm has occurred.

Each DTE port has 3 LEDs; STATUS, TX (Transmit) and RX (Receive). The status LED is normally green, yellow to indicate a minor alarm and red to indicate a major alarm. The transmit and receive LEDs have two states on or off. These LEDs indicate data activity on the transmit and receive leads.

The T1 network also has 3 LEDs; STATUS, TX (Transmit) and RX (Receive). The status LED is normally green and turns yellow to indicate a minor alarm and red to indicate a major alarm. The transmit LED has two states; on or off. The receive LED has three states, on (green), off, or yellow. Yellow indicates receipt of an unknown (unmapped) cell. These LEDs indicate cell activity (excluding idle cells) in the transmit and receive directions.

**Table 2.1 - CellPath 90 Alarms**

Alarm	Major	Minor
System	Loadable hardware device failed during a system reset	Code checksum error
Network	Loss of Signal Loss of Frame Sync Clock source has been lost Red, Yellow (remote alarm), Blue (AIS) Loss of Cells Loss of Clock Source	User initiated line, payload or DTE loopback Network initiated line, payload or DTE loopback
DTE (serial port)		Loss of DTE signal (selected control lead deasserted) User or hardware initiated bidirectional loopback
DTE (Fractional T1)	Loss of Signal Loss of Frame Sync Red, Yellow, or Blue DTE not present	User initiated DTE, Payload to Network or Network loopback

## 2.6 Circuit Emulation Services (CES) AAL1

Circuit Emulation Services (CES) AAL1 support is provided on the V.35/RS449/X.21 DTE ports and on the optional DTE-T1 port.

### 2.6.1 CES - T1

CES - T1 is intended to emulate a point-to-point Fractional T1 circuit. The service is accessed via a 1.544 Mbps DSX-1/T1 interface. For T1, N number of channels, where  $1 \leq N \leq 20$ , are carried across the ATM network and reproduced at the far end. The traffic on the DTE-T1 interface is segmented into AAL1 cells and multiplexed with traffic from other DTEs. The multiplexed traffic is then framed and sent to the ATM network.

### 2.6.1.1 Structured Mode

Structured Nx56 or Nx64 T1 service, available on the DTE-T1 interface, is modeled after fractional T1, and is useful in the following situations:

- Nx56 or Nx64 service can be configured to minimize ATM bandwidth, by utilizing only the timeslots that are actually needed.
- Nx56 or Nx64 service provides clocking to the end-user equipment, so it fits into a fully-synchronous network environment.

AAL1, as specified in ITU-T document I.363.X, has the capability to delineate repetitive, fixed-size “blocks” of data, each block being an integral number of octets in size. This capability is used in the Nx56 or Nx64 service to carry (N) DS0 timeslots, organized into blocks.

### 2.6.1.2 Structure Pointer

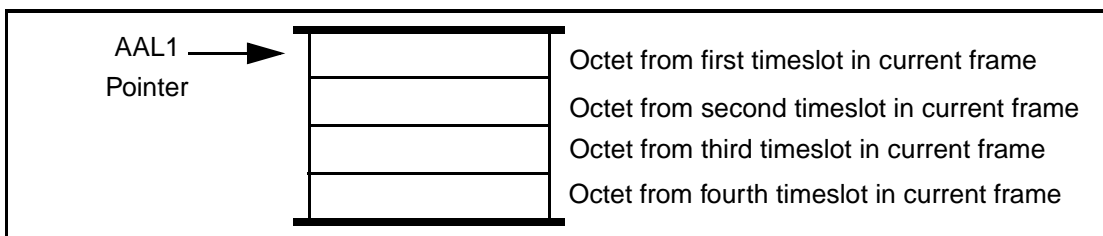
For a block size of one octet, corresponding to a single DS0 stream (N=1), the *CellPath 90* provides block delineation by aligning each octet with an AAL1 cell payload octet.

For a block size greater than one octet, the *CellPath 90* uses a pointer mechanism to indicate the start of a structure block. The pointer is inserted at the first opportunity in a cycle of eight cells.

The data transfer uses an additional control byte in some cells (those with an even Sequence Number (SN) and the Convergence Sublayer Indicator (CSI) bit set to 1) to support a Structure Pointer (SP). The SP locates the start of a block of bytes marked off by the sender. The SP field need not be present in every even-numbered cell, so the CSI is set to 1 when the SP is present, alerting the receiver that the first byte in the payload is control information and not data.

### 2.6.1.3 Cell Coding Without Carrying Signalling

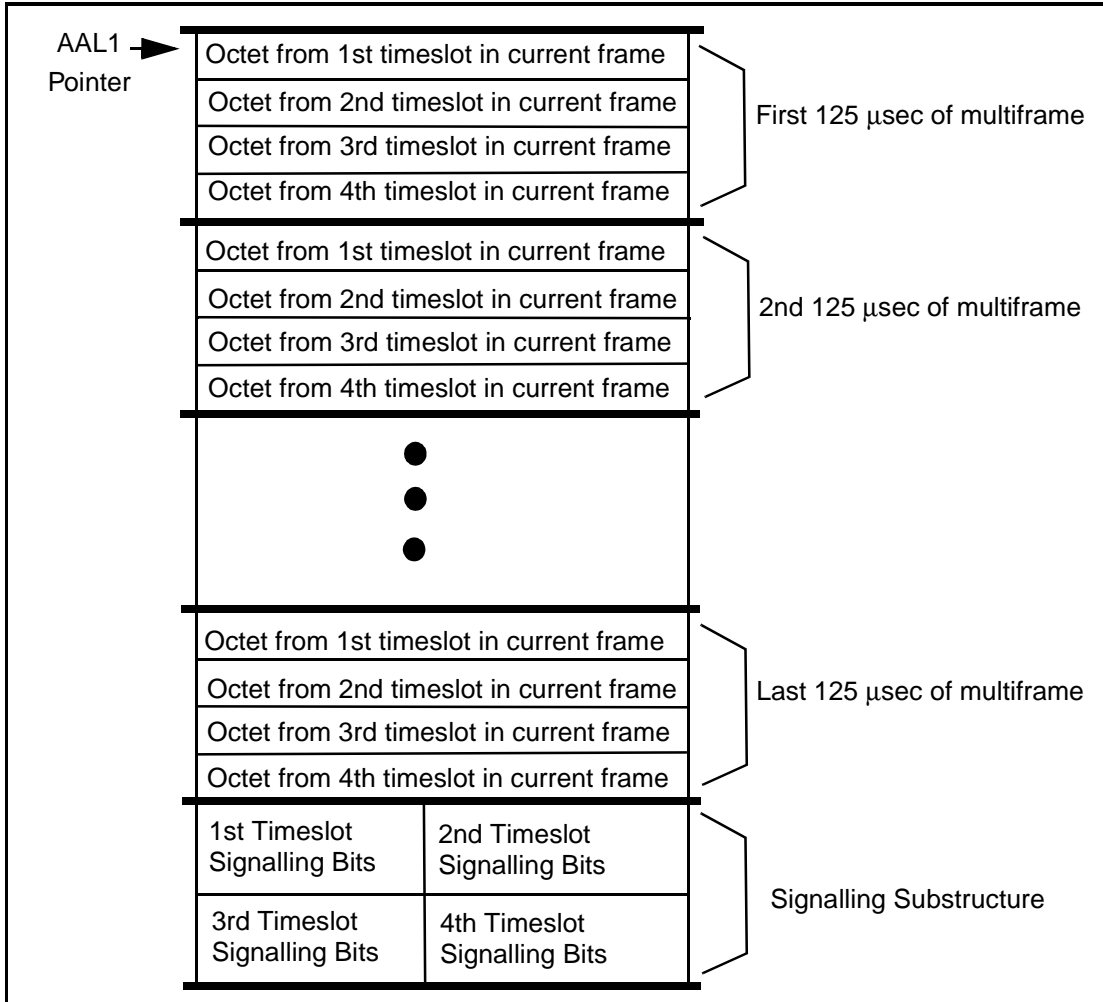
The *CellPath 90* encodes Nx64 into AAL1 cells without signalling bits, a block is created by collecting N octets - one from each of the N timeslots to be carried - and grouping them in a sequence. Figure 2.3 is an example of the block structure for N= 4.



**Figure 2.3 - Sample AAL1 Block Structure (N=4)**

#### **2.6.1.4 Cell Coding Carrying Signalling**

The *CellPath* 90 supports ABCD signalling bits. The *CellPath* 90 uses the AAL1 structure format to carry timeslots with signalling bits (see Figure 2.4). The signalling bits are extracted from the DTE T1 input data stream and saved in memory to be transmitted to the ATM network along with the voice payload. In this mode the payload part of the structure is one multiframe in length. The second portion of the AAL1 structure, called the Signalling Substructure, contains the signalling bits that are associated with the multiframe. The ABCD signalling bits associated with each timeslot are packed two sets to an octet and placed at the end of the AAL1 structure. If N is odd, the last octet contains only four signalling bits. The AAL1 structure pointer is used to indicate the first octet of the Payload Substructure.



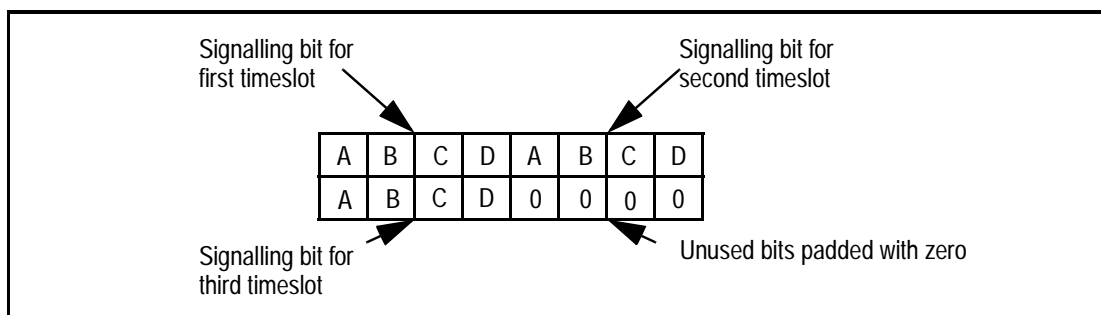
**Figure 2.4 - Cell Coding with Signalling**

In this ATM service, the remainder of the CS-PDU, the header is 47 octets of data taken directly from the input bit stream. The ATM Adaptation Layer knows nothing about the content of the data and applies no intelligence at all in handling the bit stream. It is a bit pattern that is sent in at one end and delivered unchanged at the other end regardless of whether these bits represent information or idle flags or alarm conditions. The *CellPath 90* uses unstructured mode for the V.35/RS449/X.21 CBR type traffic (non-HDLC Traffic) in synchronous

## Description

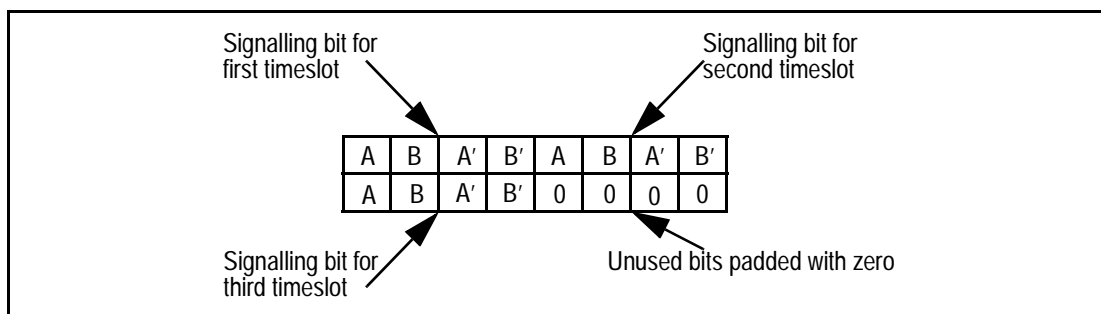
clocking mode. The assignment of bits to the (T1) signalling substructure is shown in Figure 2.5. The user interface (UI) provides a display of the ABCD signalling bits in the DTE4 Alarm screen.

Packing of the signalling bits for DS1 is done by using bits 8..5 of the first octet for the first set of signalling bits, bits 4..1 of the first octet for the second set of signalling bits, and so on. Bits 4..1 of the last octet of the Signalling Substructure are unused and shall be set to zero if the VCC is configured to carry an odd number of timeslots. Figure 2.5 shows the assignment of bits to the signalling substructure.



**Figure 2.5 - Example DS1/ESF Signalling Substructure**

DS1 with Superframe Format (SF) can also be carried with a CES IWF. For SF format, the AAL1 structure is made the same size as the equivalent ESF structure by sending two SF multiframes together in one AAL1 block, instead of one multiframe as is done in ESF framing. For SF format, the signalling octets at the end of the AAL1 structure contain AB signalling bits from the two SF multiframes in the structure. Figure 2.6 shows the signalling substructure detail for an example circuit of N=3. In this example, signalling bits AB are from the first SF multiframe in the AAL1 structure, while A'B' are from the second SF multiframe.



**Figure 2.6 - Example DS1/SF Signalling Substructure**

## 2.6.2 V.35/RS449/X.21 CES Service

Traffic on the V.35/RS449/X.21 ports can support both Variable Bit Rate (VBR) or Constant Bit Rate (CBR) unstructured type traffic. It is software programmable from the network management port. These ports support a continuous clock with data rates of  $N \times 56$  or  $N \times 64$  kbps in increments where  $N=1$  to 20.

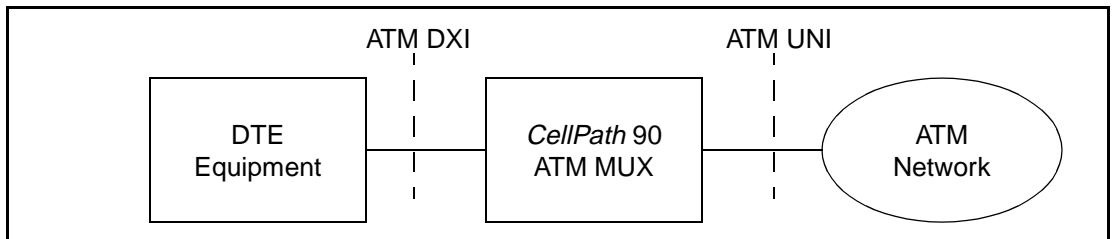
Additionally, a Structured AAL1 V.35 CBR mode, without signalling, is supported. This feature allows user to connect equipment, such as group videoconferencing systems, to serial ports at remote sites and to groom these connections onto DS1 ports at a central site for connection to a video bridge (i.e., multi-port control unit (MCU)).

## 2.7 ATM DXI Mode 1a Support

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The *CellPath 90* supports ATM DXI Mode 1a which is configurable on a per DTE port (DTE1 and/or DTE2) basis (see Figure 2.7). The following parameters are supported in this mode of operation:

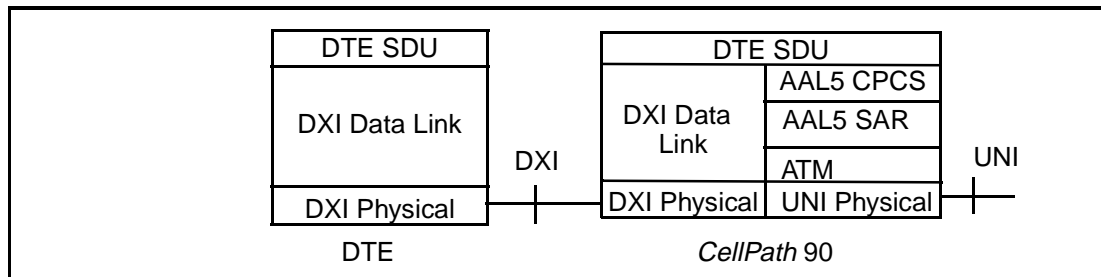
- Up to 256 Virtual Connections
- AAL5 only
- Up to 9232 octets (DTE Service Data Unit (SDU) )
- 16 bit FCS between the DTE and *CellPath 90*



**Figure 2.7 - ATM DXI**

The *CellPath 90* performs the following functions:

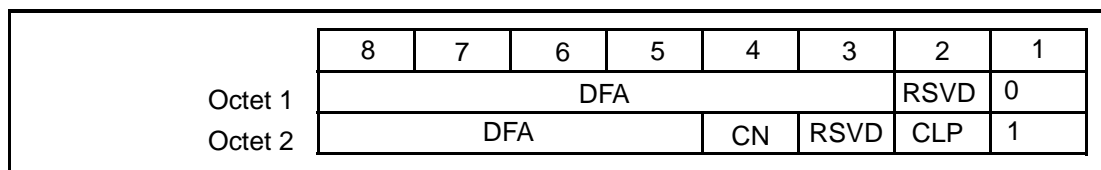
- ATM Adaptation layer 5 Common Part Convergence Sublayer (AAL5 CPCS) (Figure 2.8)
- AAL5 Segmentation and Reassembly (AAL5 SAR)
- ATM functionality
- ATM User to Network Interface (UNI)



**Figure 2.8 - Mode 1a Protocol Architecture**

The DTE generates the DXI header (Figure 2.9), encapsulates the DTE SDU into a DXI frame, and transports it to the *CellPath 90*. The *CellPath 90* strips off the DXI frame to gain access to DTE SDU and associated DXI Frame Address (DFA). The DTE's SDU is then enclosed in an AAL5 CPCS PDU (Figure 2.10) and segmented into AAL5 SAR PDUs.

The *CellPath 90* maps the DFA to the appropriate VPI.VCI and forms the ATM cells. This process is reversed for data transmission from the network to the DTE.



**Figure 2.9 - DXI Header**

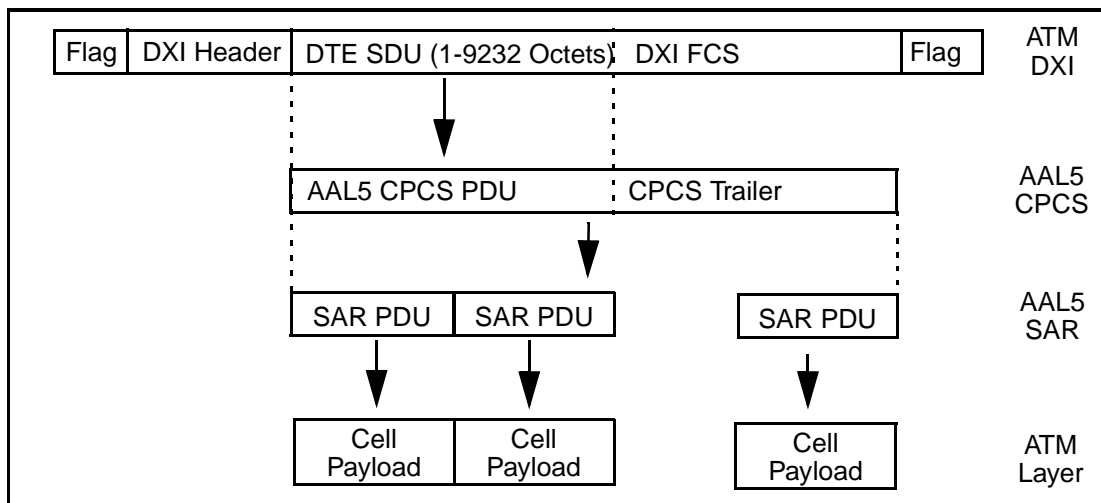


Figure 2.10 - AAL5 CPCS PDU

## 2.7.1 Explicit Forward Congestion Indicator (EFCI)

The *CellPath* 90 sets the Explicit Forward Congestion Indicator (EFCI) bit to 1 if PTI = 01x in the last ATM cell composing the DXI frame, otherwise it is set to 0 (*CellPath* 90 to DTE). DTE always sets EFCI to 0 (DTE to *CellPath* 90).

## 2.7.2 Cell Loss Priority (CLP)

The *CellPath* 90 sets the Cell Loss Priority (CLP) bit to zero (*CellPath* 90 to DTE). The *CellPath* 90 copies the CLP bit sent from the DTE into the ATM cell header CLP bit (DTE to *CellPath* 90).

# 2.8 Frame Relay over ATM

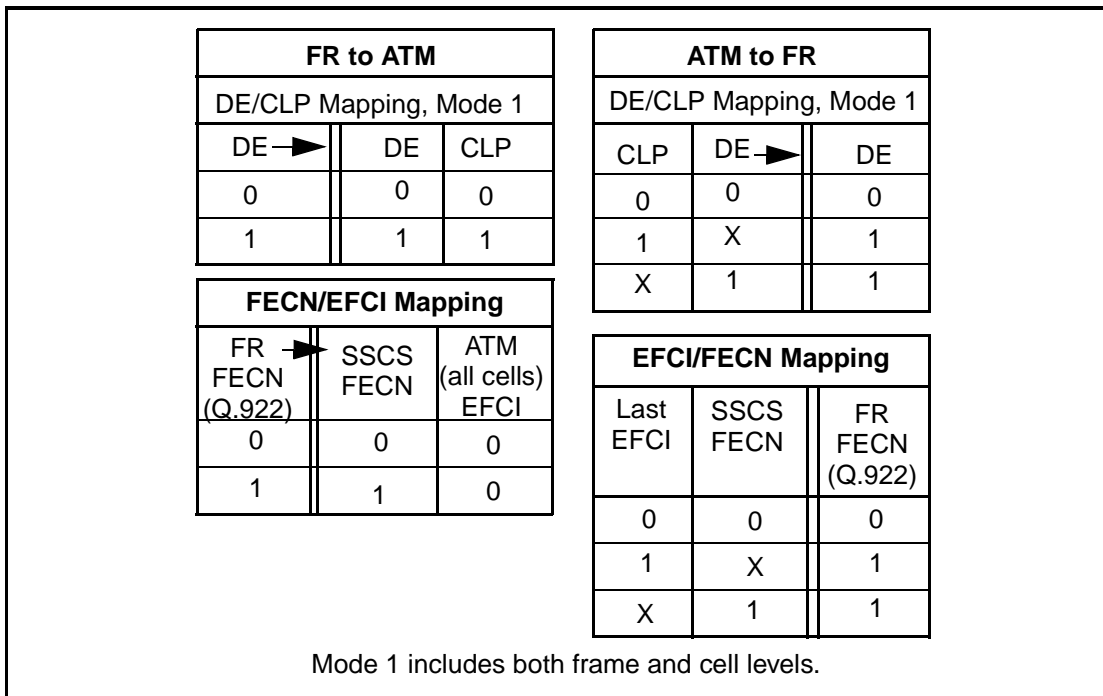
## 2.8.1 Frame Relay/ATM Service Interworking

Service interworking applies when a Frame Relay service user interworks with an ATM service user, and the ATM service user performs no Frame Relay specific functions, and Frame Relay service user performs no ATM service specific functions. All interworking is performed by the interworking function (IWF). Since ATM terminals do not support all of the I.233.1 type core services, interworking functions are needed.

For serial data links carrying Frame Relay frames, the *CellPath* 90 can be configured to map the Frame Relay PDUs to ATM PVCs based on the Frame Relay Data Link Connection Identifier (DLCI) contained in the Frame Relay header. This mapping is performed in accordance with Frame Relay Forum FRF.8 Frame Relay Service Interworking Specification.

## 2.8.2 Control Bit Mapping

Interworking between ATM and Frame Relay involves the mapping of control bits between the two formats. The other control bit, C/R, is passed transparently. DE in the Frame Relay frame maps to the ATM CLP bit in Mode 1, as illustrated in Figure 2.11.



**Figure 2.11 - Control Bit Mapping**

*Description*

# CHAPTER 3

## Getting Started

### 3.1 Introduction

---

This chapter covers general safety, tools and equipment needed to install the *CellPath 90*. It also provides information on system power and environmental requirements. This chapter provides installation procedures and configuration guidelines for the *CellPath 90* ATM T1 WAN Multiplexer.

#### 3.1.1 General Safety

Follow the basic guidelines below to ensure safe installation of the *CellPath 90*:

- The *CellPath 90* is not equipped with an On/Off switch. Ensure that during installation the unit is NOT plugged in.
- Do not remove the chassis cover.
- The *CellPath 90* is only available with 110/240 Volts AC power.

#### 3.1.2 Tools and Equipment

The following tools and equipment are needed to properly install the *CellPath 90*:

- Phillips and/or standard screwdriver.
- 3/16 Nutdriver for DTE and network connections.
- AC and DC Voltmeter.

#### 3.1.3 Unpacking

The *CellPath 90* arrives in the shipping box that contains basic equipment, power cable, RS232 serial cable, rack mount brackets (w/screws), user's manual and release notes. If an optional module was ordered with the unit it was installed and tested by the factory prior to shipment. Please check and inspect the packing list to ensure shipping accuracy. If the chassis or any other items appear damaged, pieces are missing, or problems are encountered when installing or configuring your system, contact FORE Systems help line.

Save all shipping materials when unpacking your equipment, until the equipment is installed and running normally as this may be needed in case the equipment has to be returned to the factory for any reason. A pre-authorized Return Material Authorization (RMA) number is required to return equipment to FORE Systems, Inc. Contact FORE Systems Customer Service for assistance. The telephone number can be found in the *Preface*.

### 3.1.4 Site Requirements

#### 3.1.4.1 Environment

The *CellPath 90* is designed to be a rack-mount device. A rack-mount kit, for mounting the equipment either in a 19" (48.26cm) or 23" (58.42cm) rack, is included in the shipping carton with the unit. Since the *CellPath 90* is convection cooled, there **MUST** be a minimum of one-half (1/2") inch (1.27cm) of space between the top of this multiplexer and any equipment mounted above it. The maximum operating temperature is 122°F (50°C). This equipment may not operate properly if the ambient temperature rises above 122°F (50°C).

The *CellPath 90* environmental specifications are:

- Temperature: 32 to 122°F (0 to 50°C)
- Humidity: 0 to 95% non-condensing
- Altitude: 0 to 10,000 feet (0 to 3048 meters)
- Storage Altitude: 15,000 feet (4572 meters) Above Sea Level
- Storage Temp: -4° to 140°F (-20° to 60°C)

*Elevated Operating Ambient Temperature:* If the *CellPath 90* is installed in a closed or multi-unit rack assembly, the operating ambient temperature of the rack environment may be greater than room ambient temperature. Therefore, consideration should be given to installing the equipment in an environment compatible with the 122°F (50°C) maximum ambient temperature.

#### 3.1.4.2 Rack Mounting the Chassis

Depending on the rack size you are using, attach the supplied rack-mount brackets to the chassis on either side. Attach the chassis-bracket assemblies to the vertical rack rails.

#### CAUTION



*Reduced Air Flow:* Installation of the equipment in a rack should be such that the amount of the air flow required for safe operation of the equipment is not compromised. There must be a minimum of one-half (1/2") inch (1.27cm) of

space between the top of the *CellPath* 90 and any equipment mounted above it. In addition, to allow for proper air flow, the sides and top air vents must **NOT** be blocked.

### 3.1.4.3 Power

The *CellPath* 90 is equipped with a 110/220 volts AC power supply. The electrical characteristics are:

- AC Power 90 to 244 V AC at 48 to 60 Hz
- AC Fuse Replaceable Slow Blow, 1 Amp @250V
- Maximum Power Consumption 25 Watts

#### CAUTION



For continued protection against risk of fire, replace only with the same type and rating fuse.

For 220/240 volts operation, a special power cord is required to plug it into the appropriate electrical outlet for the country in which it is to be installed. Contact FORE Systems for assistance in selecting the proper AC cable. Notice that the *CellPath* 90 is not equipped with an On/Off switch. If you desire this capability, an external in-line switch is required.

#### 3.1.4.3.1 Circuit Overloading

Consideration should be given to the connection of the equipment to the supply circuit and ensuring that this circuit is not over loaded.

#### 3.1.4.3.2 Reliable Earth Ground

Reliable earth ground between the rack and equipment should be maintained. Ensure that the rack is well grounded and also tie the chassis of the equipment to the ground. A ground point is provided on the back of the unit for a ground connection.

## 3.2 Hardware Overview

The *CellPath 90* is comprised of a main module with two DTE serial ports and an ATM network port. An optional T1/Ethernet module is available which adds an Ethernet (DTE3) and a T1 (DTE4) port.

### 3.2.1 Front Panel

The *CellPath 90* front panel provides overall system status, port status, TX and RX LEDs, DIP switches for setting NMS port parameters, and transmit (TX) and receive (RX) monitor jacks. Refer to Figure 3.1 for a representation of the front panel.



Figure 3.1 - *CellPath 90* Front Panel

#### 3.2.1.1 Status LEDs

The *CellPath 90* status LED indicators located on the front panel allow the user to visually check the status of the system and ports.

LED Color	Alarm Condition	Probable Cause/Symptom
Green	No alarm	Normal Operation
Yellow	Minor alarm/Test	Error at remote end
Red	Major alarm	Loss of T1 connection

#### 3.2.1.2 TX/RX Indicators

The TX and RX LEDs indicate the state of the transmit and receive lines. These may represent different conditions depending on the type of port. Normally, when the TX or RX LED is green this indicates that data is either being transmitted or received on the appropriate port.

#### 3.2.1.3 NMS (RS-232C) Port DIP Switches

An 8 position DIP switch is provided to configure the Network Management System (NMS) RS-232C port. Switch position 8 is reserved for maintenance use. Refer to *Chapter 4, Configuration* for details on setting the DIP switches.

### 3.2.1.4 TX/RX Monitor Jacks

Two monitor jacks are provided for monitoring the network signal using an external data test set.

## 3.2.2 Rear Panel

The *CellPath 90* rear panel provides connections to the following interfaces as shown in Figure 3.2. Refer to *Appendix D, Connector Pinouts*, for descriptions of the pin assignments for each rear panel interface connector.



**Figure 3.2 - *CellPath 90* Rear Panel**

### 3.2.2.1 DTE 1/2

The basic unit is equipped with two (2) V.35/RS449/X.21 serial ports equipped with EIA-530A compatible female DB-25 connectors. FORE Systems can provide the cables necessary for connection to your equipment.

### 3.2.2.2 External Clock

A DB-9 female connector is provided for an external clock. An external clock source can be connected to this port in place of the network or internal clock. The interface requires a differential (200 mvolts to 5 volts) input signal or single ended TTL (0.8 volts to 5 volts) level.

### 3.2.2.3 NMS Port

The NMS port is equipped with a DB-9 female connector. Electrically, it is an RS232 interface. This interface allows the connection of multiple (up to 16) *CellPath 90* Multiplexers to the local network manager or a VT100 Terminal. A multidrop cable is available from FORE Systems. FORE Systems can accommodate your custom cable needs. If custom cables are required, contact your FORE Systems sales representative.

### 3.2.2.4 T1 Network

The T1 Network interface is equipped with a DB-15 female connector labeled “100Ω”. This port meets FCC Part 68 network safety requirements.

### 3.2.2.5 Alarm & -48V Connection

These connections may appear on the back of your *CellPath* 90. These options are no longer supported or available.

#### 3.2.2.6 AC Power

The AC power connector on the *CellPath* 90 is protected by a 250 volt 1.0 Ampere slo-blow fuse. A spare fuse is provided in the same fuse holder.

#### CAUTION



For continued protection against risk of fire, replace only with the same type and rating of fuse.

### 3.2.3 Optional T1/Ethernet Module

The optional T1/Ethernet module provides an additional set of T1 connections for the DTE4 interface and a DB-15 Ethernet interface. Refer to Figure 3.2 for the location of these interface connections.

#### 3.2.3.1 DTE3 Ethernet

The Ethernet port is a DB-15 female AUI connector. An external transceiver is required in order to connect the *CellPath* 90 to an Ethernet network utilizing 10Base-2 (coaxial) or 10Base-T (twisted-pair) cabling.

1. Connect an ethernet transceiver to the ethernet port
2. Connect an ethernet cable to the transceiver
3. Ensure that all connections are secure

#### 3.2.3.2 DTE4 T1

The DTE4 T1 port is equipped with a DB-15 female connector label “DTE4 T1”. Equipment with a T1 interface such as a PBX or channel bank can be connected to this port. This port meets DSX-1 electrical requirements.

## 3.3 Cabling

---

This section describes the cabling requirements for your *CellPath 90*. All of the connectors on the *CellPath 90* are female connectors. The *CellPath 90* configuration determines the requirements for cabling options. Please ensure that you have ordered the required cables from FORE Systems. Consult FORE Systems for assistance in selecting the appropriate cables for your particular installation. All port connections are made on the rear of the unit. Refer to *Appendix D, Connector Pinouts* for pinouts of each interface.

Cabling is a very important item to consider from the point-of-view of both the quality of cable and cable length when installing communication equipment. Using shielded twisted pair cables with good grounding between the equipment provides the most reliable data and telecommunication service. The distance between the *CellPath 90* and the connecting equipment is equally important for reliable operation. For example, the distance limitations for the RS232 interface varies based on the cable type and the transmission rate. The recommended distance for RS232 at 9600 baud is 50 feet maximum. The maximum distance between the T1 DTE port and the connecting equipment is limited to 655 feet. V.35 and RS449 can transmit and receive data over greater distances than RS232.

### 3.3.1 NMS Port

The *CellPath 90* is equipped with an asynchronous Network Management System (NMS) DB-9 female RS232C interface configured as a Data Communication Equipment (DCE) port.

Multiple *CellPath 90* units can be daisy chained together using a multidrop cable. Multidrop cables are available through FORE Systems as standard items; FORE Systems can also make custom cables to meet your particular cabling requirements.

### 3.3.2 T1 Network Port

The T1 Network port is a DB-15 female connector labeled “100Ω”. The T1 Network port is a four wire interface, two are used for transmit and two for receive. This interface meets AT&T Publication 62411 and Accunet T1.5 specifications and is designed to meet the safety requirements specified in FCC Part 68 (lightning hazards), UL1950 (AC hazards) and Bellcore TR-TSY-000007.

### 3.3.3 DTE 1/2 Ports

The basic unit is equipped with two V.35/RS449/X.21 DTE serial interface ports. The bottom is labeled “DTE1” and the top “DTE2”. Both DTE interfaces are EIA-530A DCE compliant. DTE 1 and DTE 2 can be configured to accommodate V.35 or RS449/X.21.

### **3.3.4 DTE 3 Ethernet Port**

The DTE 3 Ethernet port is labeled “DTE3 Ethernet”. This connector is located on the optional T1/Ethernet daughter board. All standard 15-pin Ethernet transceiver modules meeting IEEE 802.3 can mate with this connector. An external transceiver is required to connect the *CellPath* 90 for Coaxial or Twisted pair Ethernet.

### **3.3.5 DTE 4 T1 Port**

The DTE4 T1 port is also located on the optional T1/Ethernet daughter board and is label “DTE4 T1”. The DTE4 T1 is a DSX-1 type interface designed for connection to a PBX, Channel Bank or other T1 Multiplexer equipment. The distance to this equipment is limited to 655 ft.

### **3.3.6 External Clock Connection**

The *CellPath* 90 is equipped with the capability to accept an external clock as the input clock. This connector, marked “EXT CLK”, is a female DB-9 connector located above the NMS connector.

## **3.4 Terminal Connection**

---

The easiest way to configure the *CellPath* 90 is via terminal (VT100) mode. Connect the serial port of a local VT100 compatible terminal to the *CellPath* 90 NMS port. Set the front panel switches to match the appropriate terminal parameters. The *CellPath* 90 DIP switch settings are listed in Table 3.1.

**Table 3.1 - Front Panel DIP Switches**

Switch	Setting	Option	Default
SW1	On Off	Terminal SNMP	On
SW2	On Off	Parity On Parity Off	Off
SW3	On Off	Even Parity Odd Parity	Off
SW4	On Off	7 Data Bits 8 Data Bits	Off
SW5	On Off	1 Stop Bit 2 Stop Bits	On
SW6/SW7	Off/Off Off/On On/Off On/On	1200 Baud 2800 Baud 9600 Baud 19200 Baud	9600 Baud

## 3.5 Powering Up the *CellPath 90*

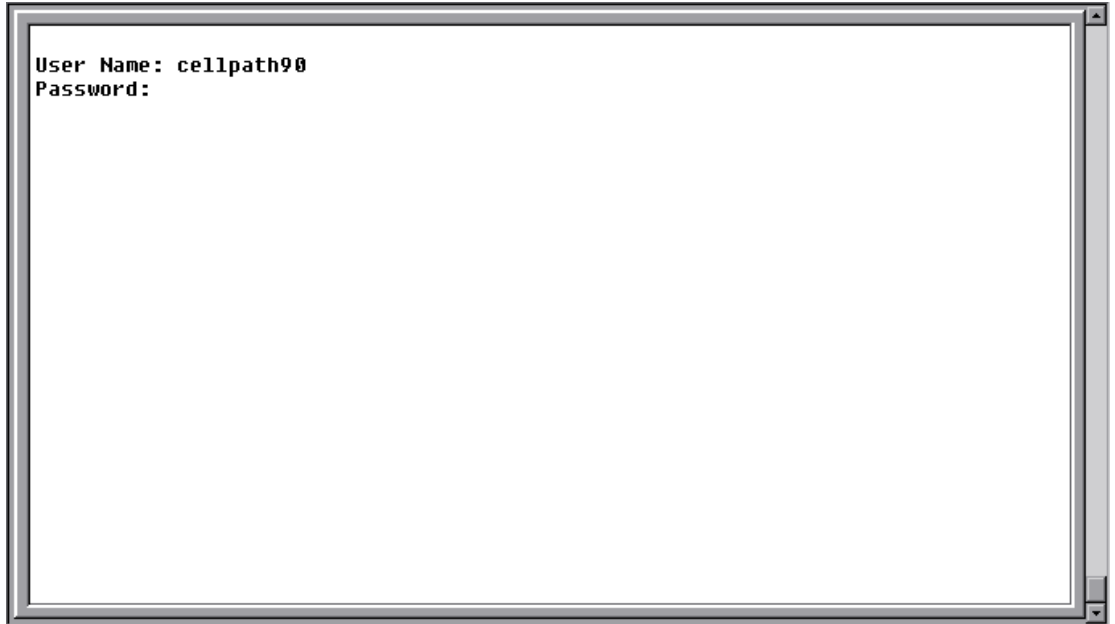
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### CAUTION



Hazardous voltages at the Telephone Company's T1 interface may exist. Check the DC voltage across the T1 interface from the telephone company before installing T1 lines. If High DC voltages exist (as high as 200 Volts DC), DO NOT proceed with T1 equipment installation. These voltages are hazardous and can cause death or severe injury to personnel. Call the serving telephone company to temporarily disconnect the power to your T1 line until the installation is completed.

At this point the *CellPath* 90 should have been unpacked and all required cables installed. Insert the power cord into the AC power receptacle on the back of the *CellPath* 90. The *CellPath* 90 should display a login prompt as shown in Figure 3.3. Enter `cellpath90` and press the <Enter> key, for the User Name. Press the <Enter> key for the default Password. Refer to *Chapter 4, Configuration* to continue with configuring the *CellPath* 90.



**Figure 3.3 - *CellPath* 90 Login Prompt Screen**

# CHAPTER 4

## Configuration

The *CellPath* 90 performs a series of internal diagnostics when power is applied. After performing these internal diagnostics, the *CellPath* 90 is ready for operation. The *CellPath* 90 is shipped with factory defaults to minimize the time required for configuration by the user. The factory default settings are shown in the menus and screens throughout this chapter. If a VT100 compatible terminal is being utilized as a Network Management Station (NMS) refer to 4.1, *Using a Terminal as an NMS*. If your *CellPath* 90 is connected to an Simple Network Management Protocol (SNMP) Manager, refer to *SNMP Management*.

### 4.1 Using a Terminal as an NMS

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#### 4.1.1 NMS Port Settings

The *CellPath* 90 is equipped with an asynchronous RS-232C NMS port configured as a Data Communication Equipment (DCE) port utilizing a DB-9 female connector. The factory default settings for the NMS port are:

- Baud rate 9600
- Data bits: 8
- Parity none
- Stop Bit: 1

The factory default terminal settings can be modified by changing the front panel DIP switch settings (refer to *Chapter 3, Getting Started*), from the SYSTEM->TERM menu (Figure 4.24) or from an SNMP Management station.



#### NOTE

The baud rate of the *CellPath* 90 is limited to 19,200 bps through the front panel DIP switches, however, the baud rate can be increased to 115,200 bps either through the SYSTEM->TERM menu or SNMP Manager. Also note that the baud rate actually executed is the one that was last set *chronologically* whether from the DIP switches, TERM menu or SNMP Manager.

## 4.1.2 Terminal Configuration

The easiest way to configure the *CellPath 90* is via a VT100 compatible terminal. Connect the terminal serial port to the *CellPath 90* NMS port. Typical serial ports are RS-232C DB-9, which is compatible with the *CellPath 90*. The default switch settings should allow communication with the terminal.

## 4.2 SNMP Management

---

Simple Network Management Protocol (SNMP) is the most commonly used protocol for managing network equipment. The *CellPath 90* is provided with a built-in SNMP agent, which enables the user to select any standard network manager. Both standard (RFC-1406) and Enterprise MIBs are available in computer readable format from FORE Systems, Inc.

### 4.2.1 SNMP Installation for the SLIP port

The *CellPath 90* is equipped with an asynchronous NMS port configured as a Data Communication Equipment (DCE) port using a DB-9 female connector. The initial port settings are set through the DIP switches located on the front panel. The following steps should be used to configure for SNMP:

1. Set front panel DIP switch SW1 to the Off position. (This changes the *CellPath 90* NMS port protocol from ASCII VT100 to SNMP strings.)
2. Connect a Network Manager to the *CellPath 90* NMS port ensuring that the NMS port parameters (baud rate, stop bits, parity, data length) match the NMS setting.

### 4.2.2 SNMP Configuration for the SLIP Port

Read, Write, and Trap community strings may be entered in the SYSTEM->SNMP Menu (see Figure 4.22). The SYSTEM->INTERFACES Menu (Figure 4.23) allows the user to enter the appropriate SLIP Internet Protocol (IP) addresses and mask which are used to support SNMP. Additionally, an ATM connection is required to be setup in the ATM Configuration Menu to support an inband SNMP session.

- *READ community string*: Programs the unit to respond to *get* or *get-next* requests for SNMP messages with the matching community string. Messages whose community string do not match this string are rejected.
- *WRITE community string*: Programs the unit to accept set requests for SNMP messages with the matching community string. Messages whose community string do not match this string are rejected.

- *TRAP community string*: Used as the community string to trap messages sent to the network manager.

### 4.2.3 SNMP MIBs

The *CellPath 90* supports several SNMP Management Information Bases (MIBs). The DS1/E1 MIB (RFC-1406), TCP/IP (RFC-1155), RFC-1212, RFC-1213, RFC1215, and a *CellPath 90* enterprise MIB. The specific variables in those MIBs are beyond the scope of this manual. Please refer to the respective MIB for documentation on variable settings. Please note that the variables in the enterprise MIB closely match the settings available from through the menu interface, so the menu interface document may be used as a model for the enterprise MIB variable settings.

## 4.3 Logging In and Out

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### 4.3.1 Logging In

A user name and password are required to log into the *CellPath 90* user interface. Additionally, a unit name is required whenever the multidrop option is enabled. At the login prompt, enter the user name, then press the <Enter> key. At the password prompt, enter the password, then press the <Enter> key.



User names and passwords are case sensitive. The unit is shipped without a Supervisor password. It is advised that a Supervisor password be set by the system administrator at the earliest convenience.

```
User Name:  cellpath90<Enter>
Password:  <Enter>
```

When the multidrop option is used:

```
Unit Name:  xxxxxxxxxxxxxxxxx<Enter>
User Name:  cellpath90<Enter>
Password:  <Enter>
```

### 4.3.2 Logging Out

To log out of the *CellPath 90*, select LOGOUT from the MAIN menu, then press the <Enter> key.

## 4.4 Main Menu Overview

---

The first line of the main menu (Figure 4.1) provides the current software release level and a user entry field containing the unit name. The unit name is a user definable name consisting of up to 16 alpha-numeric characters. The second line contains headings of the various user interface (UI) menus and screens. These menus and screens are listed below and defined later in this chapter. The bottom line displays the hardware revision level, unit serial number, and the current date and time. The unit name and date and time are user configurable and can be changed, or set, by the system administrator. The available menus and screens, and the respective functions, are:



The Date field is entered as MO/DA/YEAR in standard US format. The Time field is entered in 24-hour format as HR:MN:SC. All fields are required for both the Date and Time.

- **ALARM**  
Displays current *CellPath 90* unit and port status.
- **CONFIG**  
Provides menus to configure the *CellPath 90*.
- **STATISTICS**  
Provides the ability to view *CellPath 90* DS1 Network Statistics and ATM Counters with options to Clear ALL Statistics, or selectively clear the DS1 Network Statistics or ATM Counters.



All statistics are cleared when the unit is powered off.

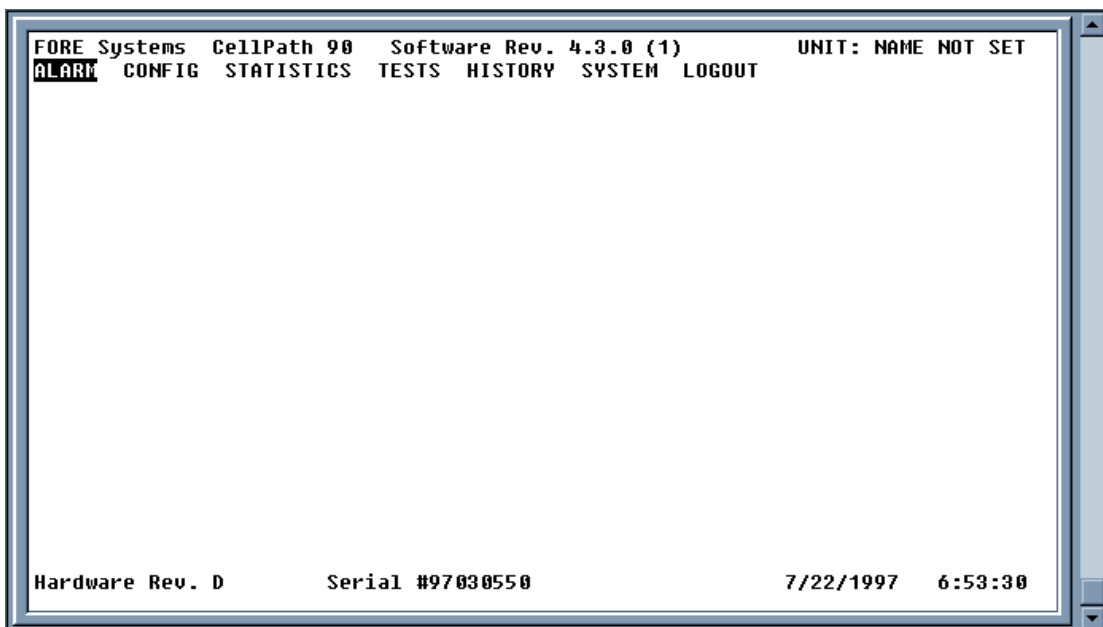
- **TESTS**  
Provides troubleshooting aids to diagnose problems arising during installation or operation of the *CellPath 90*.

- **HISTORY**  
Provides a log of all events/alarms that have occurred since the last time the system was powered on. The last 24 hours (in 15-minute intervals) are maintained in the history file. An option is provided to clear the history display.



The history file is cleared when the unit is powered off.

- **SYSTEM**  
Contains system level menus to assign USERS, set SNMP community strings, set INTERFACE IP addresses, change TERMinal parameters, and execute system OPERATIONS functions.



**Figure 4.1 - Main Menu**

## 4.4.1 Using the Menus

User Interface (UI) menu operation is simple and user friendly. The first line displays the manufacturer, system name, software revision currently running and a unit name. The second line displays the top level menus while the next line, when a top level option is selected, displays lower level menus and/or screens. When a menu item is selected, by pressing the right, left, up, or down arrow key, it is displayed in reverse video (see Figure 4.2).

### 4.4.1.1 Arrow Keys

The arrow keys are used to move around within a menu or screen. The up, down, right, and left arrow keys move the selection to the next editable item in the respective direction.

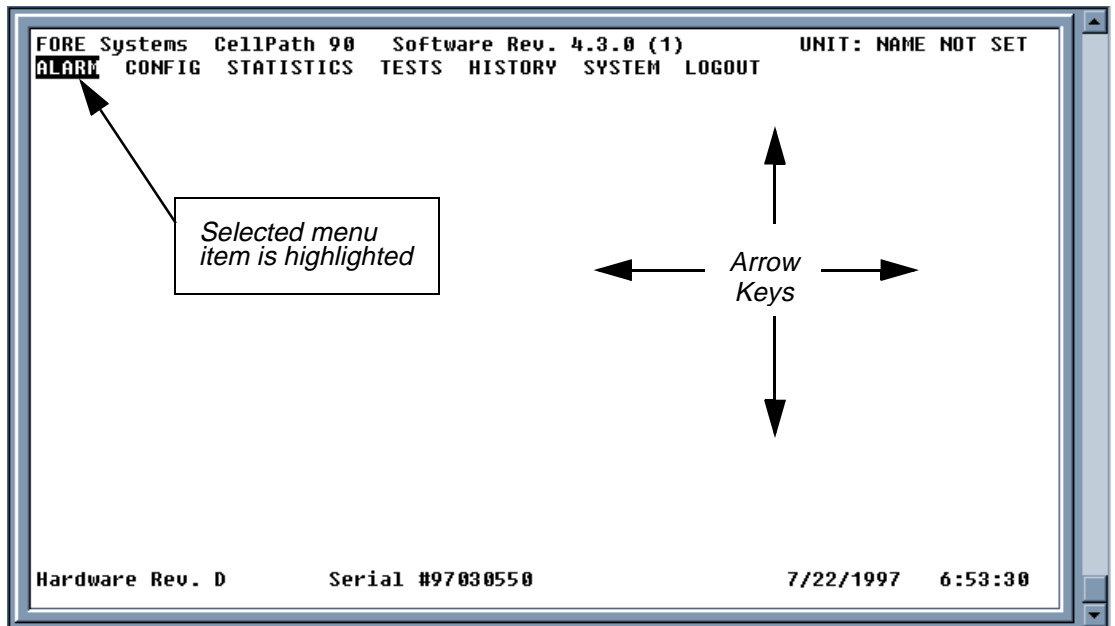


Figure 4.2 - Using the Menu

### 4.4.1.2 Enter Key

After selecting an item, pressing the <Enter> or Return key displays a sub-menu or selects an item in the current menu. To change the setting of the current menu item, press the <Spacebar> or <Backspace> key.

### 4.4.1.3 Space-Bar

Pressing the <Space-bar> cycles through available options of the currently selected item. The options are organized in a round robin fashion. Pressing the <Space-bar> increments through the options.

### 4.4.1.4 Backspace Key

Pressing the <Backspace> key displays the available options in the reverse order of the <Space-bar>. Pressing the <Backspace> key decrements through the options.

## 4.4.2 Modifying Menu Entries

To modify an entry, position the cursor on the desired field and press the <Space-bar>. Each time the <Space-bar> is pressed, it displays the next available option. For example, to change the DTE 1 interface from V.35 to RS449:

1. Select CONFIG from the main menu and press the <Enter> key.
2. Select DTE 1 and press the <Enter> key. The DTE 1 Configuration menu is displayed.
3. Press the <Space-bar>. The RS449 option is displayed.



The fourth line of the menu screen displays:  
 “To save the change, press Enter; to  
 cancel, press ESCape.”

4. To save the change, press the <Enter> key. Press the Escape (ESC) key, or move the cursor off of the current menu item, to cancel the change. If the change is not saved, the screen displays “The change has been DISCARDED” and the option is reset to what was present prior to the attempted change.

## 4.5 Alarms Menu

The ALARMS Menu (Figure 4.3) provides a display of the current alarm status of the *CellPath* 90, as well as each of the ports. If an alarm condition is detected, the STATUS LED on the front of the unit changes color from GREEN to YELLOW or RED, depending on the severity of the alarm. The ‘ALARM’ button, depending on the terminal emulation in use, becomes bold or blinks. When the ALARM Menu is selected, the button of the port experiencing the alarm becomes bold or blinks. Moving the cursor to that button and pressing the <Enter> key displays the alarm(s) causing the alarm condition.

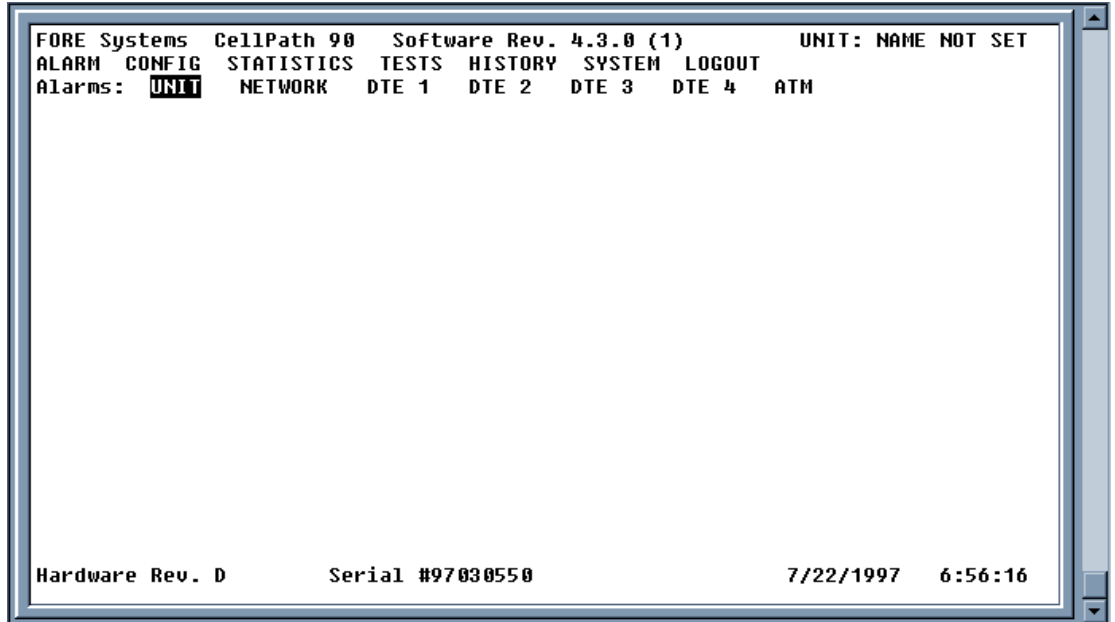


Figure 4.3 - Alarm Main Menu

### 4.5.1 Unit Alarms

Selecting UNIT displays all currently active UNIT related alarm conditions. If no alarms are active, "No alarms" is displayed.

### 4.5.2 Network Alarms

Selecting NETWORK displays all currently active NETWORK related alarm conditions. If no alarms are active, "No alarms" is displayed. Figure 4.4 displays a NETWORK Alarms screen with alarms present.

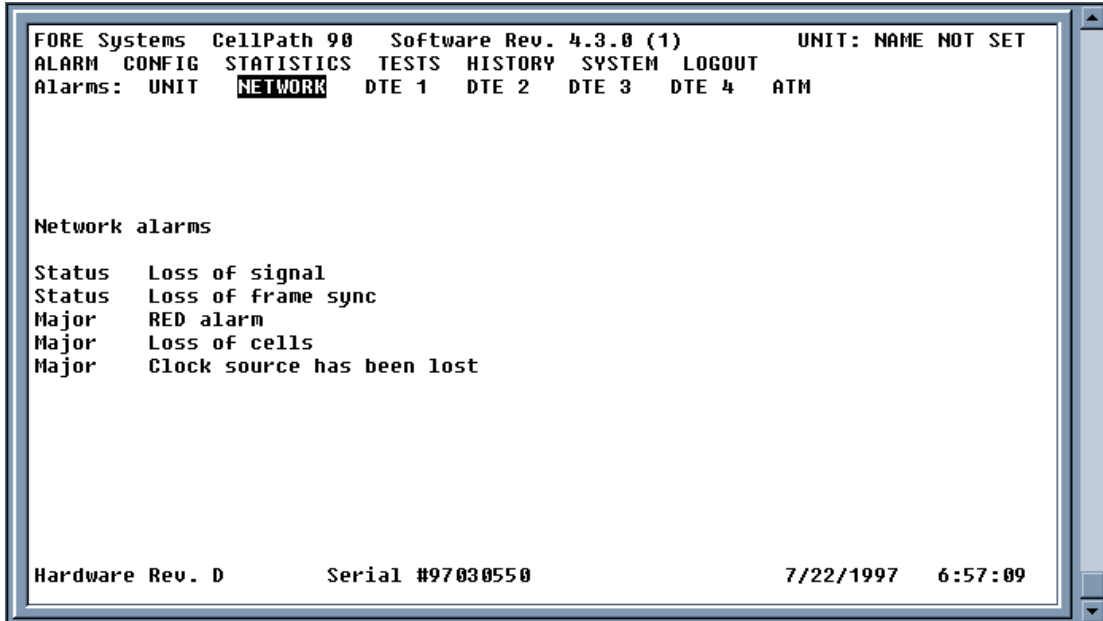


Figure 4.4 - Network Alarm Screen

### 4.5.3 DTE1/DTE2 Alarms

Selecting either the DTE1 or DTE2 alarm screens displays the current state of the DTE 1, or DTE2, control leads (whether On or Off) and any active alarm conditions (see Figure 4.5). If no alarms are present, "No Alarms" is displayed.

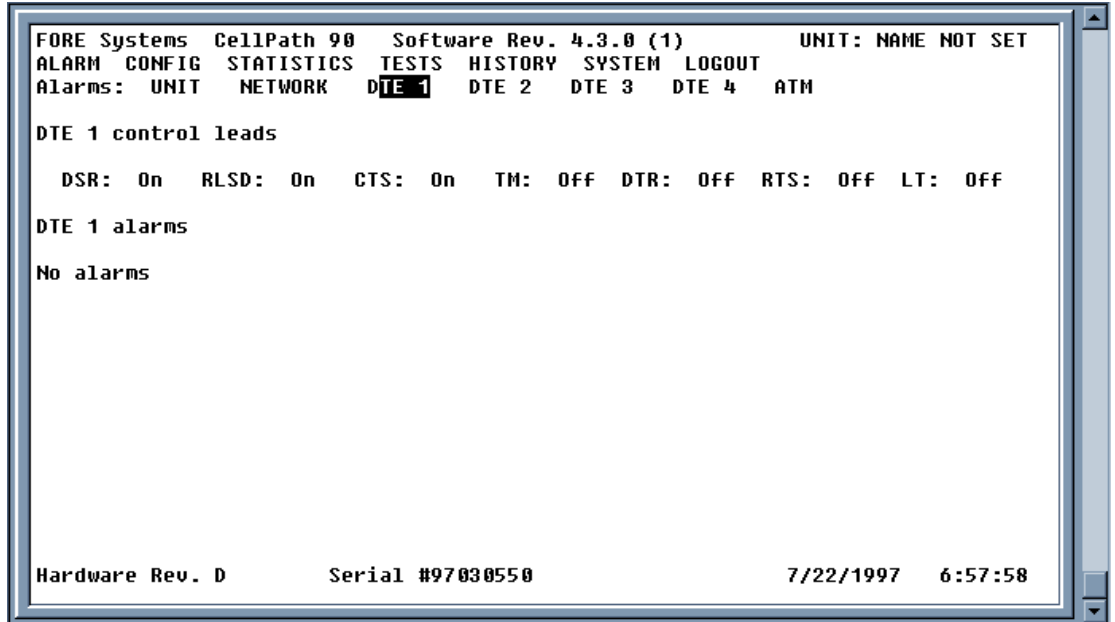


Figure 4.5 - DTE 1/DTE2 Alarms Screen

#### 4.5.4 DTE3 Alarms

Selecting the DTE3 alarms screen displays the status of any currently active DTE 3 alarms. If no alarm is present, "No Alarms" is displayed.

#### 4.5.5 DTE4 Alarms

Selecting the DTE4 alarms screen displays the status of any currently active DTE 4 alarms (see Figure 4.6). If no alarm is present, "No Alarms" is displayed. Additionally, DTE4 channel usage assignments and the state of the associated ABCD signaling bits are displayed. The ABCD signaling bit values displayed represent a hexadecimal value of the ABCD bits for the associated DS0 channel.



The initial ABCD bit display is meaningless until something is connected to the DTE4 port and traffic is flowing.

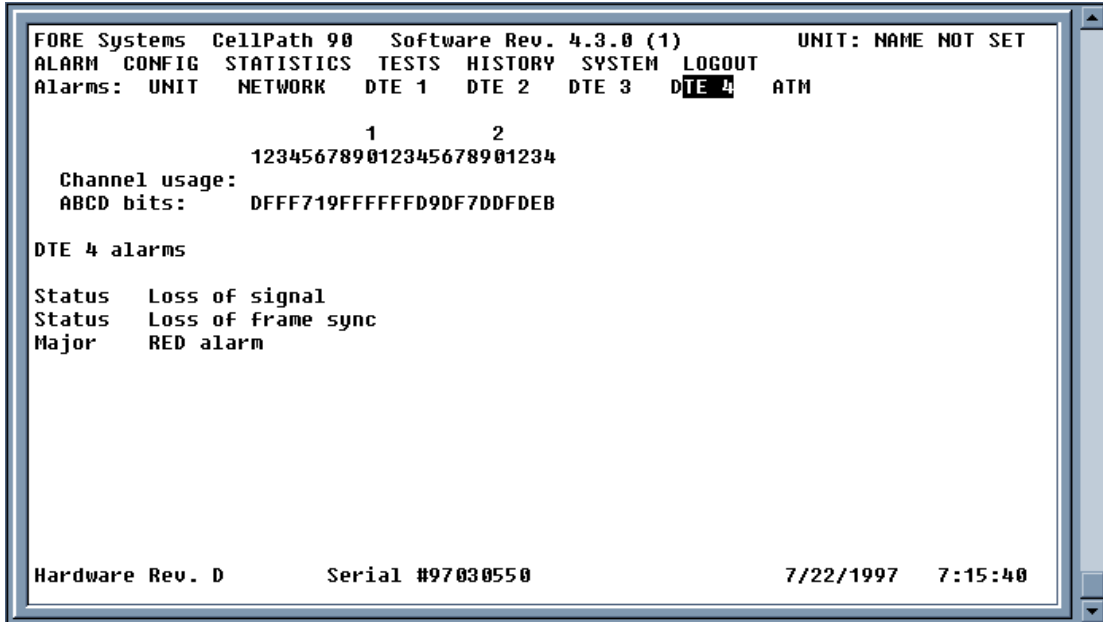


Figure 4.6 - DTE4 Alarm Screen

## 4.5.6 ATM Alarms

Selecting ATM displays all currently active ATM port alarms. If no alarm is present, "No Alarms" is displayed.

## 4.6 Config Menu

*CellPath* 90 port parameters can be configured through the CONFIG Menu (Figure 4.7). The CONFIG Menu contains sub-menus for the NETWORK, DTE ports 1 through 4 and ATM connections. An Ethernet Map screen is provided to view discovered Ethernet MAC addresses. The following paragraphs describe the configuration options available under each of the various CONFIG Menu selections. Each of the following menu screens displays the default values for each option.

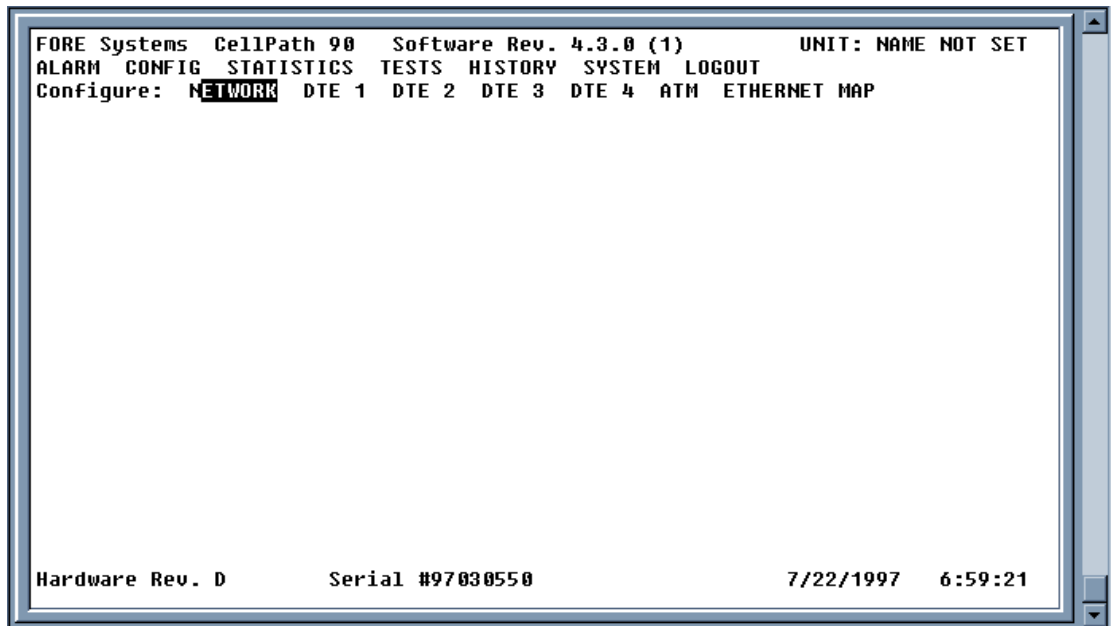
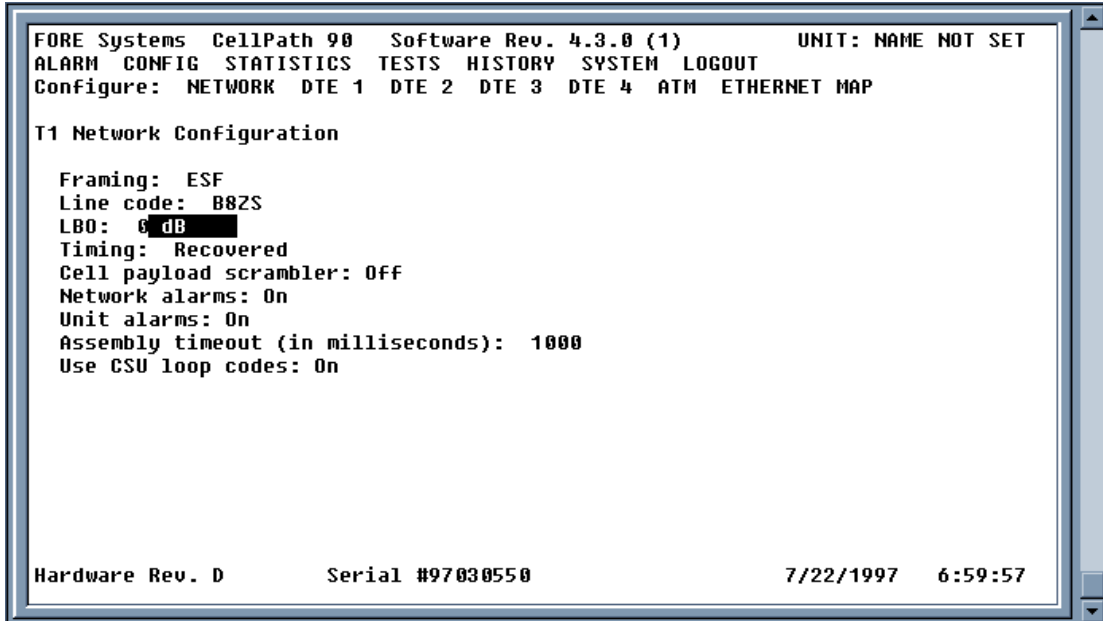


Figure 4.7 - CONFIG Main Menu

### 4.6.1 Network Configuration

Selecting NETWORK from the CONFIG Menu displays the configurable NETWORK options. The Network Configuration menu is displayed, as shown in Figure 4.8. The following paragraphs describe the options available in the NETWORK Configuration.



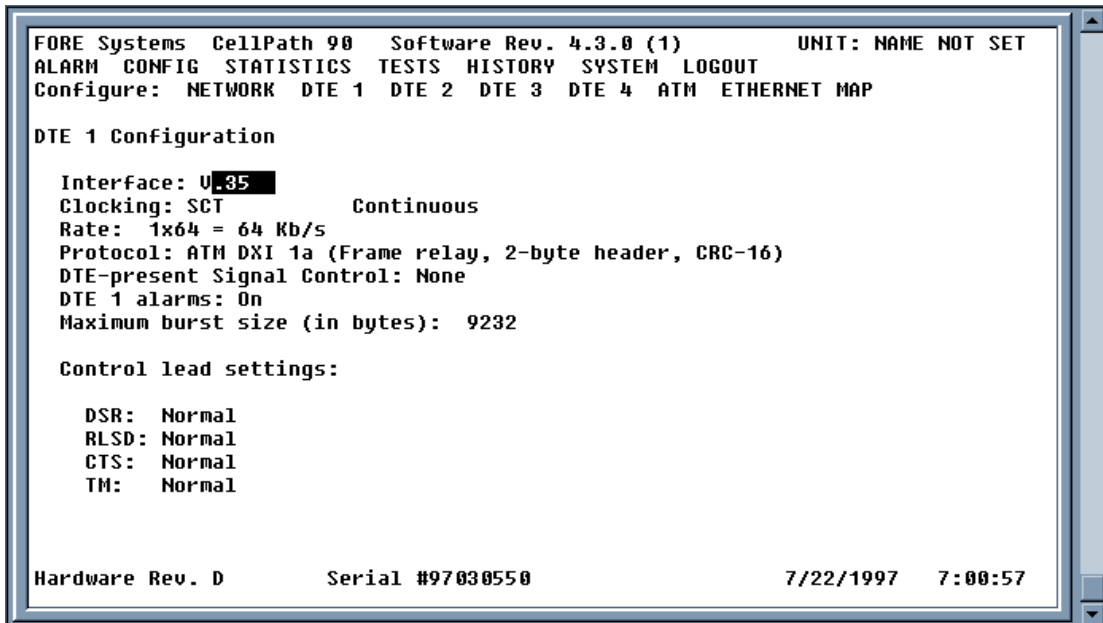
**Figure 4.8 - T1 Network Configuration Menu**

- Framing:** Defaults to ESF (Extended Superframe). No options are available.
- Line code:** Defaults to B8ZS. No options are available.
- LBO:** The LBO (Line Build Out) is based on the distance between the *CellPath 90* and connected Telco equipment. The available settings are: 0, -7.5, -15 or -22 dB. The default setting is 0 dB.
- Timing:** Recovered, External, Recovered DTE4, and Internal.
  - Recovered** - Uses clocking supplied from the network (default).
  - External** - Utilizes the External Clock connection located on the back of the *CellPath 90* (Refer to *Appendix D, Connector Pinouts* for the pinouts of this connector).

	<b>Recovered DTE4</b> - Uses clock timing supplied from the application, typically a PBX channel bank.
	<b>Internal</b> - Uses the internal Stratum 4 clock
<b>Cell payload scrambler:</b>	On or Off. If set to On, ensure that the local Telco equipment supports scrambling per ATM UNI 3.1 specifications. Cell payload scrambler set Off is the standard configuration for ATM over T1.
<b>Network alarms:</b>	On or Off. When Off, the unit does not change the Alarm LED color or turn the alarm relay on and does not send SNMP traps if a network failure is detected. For normal operation Network alarms are set On (default).
<b>Unit alarms:</b>	On or Off. When Off, the unit does not change the Unit Alarm LED color or turn the alarm relay on and does not send SNMP traps if a unit failure is detected. For normal operation Unit alarms are set On (default).
<b>Assembly time-out (in milliseconds):</b>	The <i>CellPath</i> 90 assembles full packets to be transmitted to the DTE port when receiving cells from the network. The assembly time-out value is the maximum time allowed between cells received from the network. If the set time expires, the <i>CellPath</i> 90 discards the incomplete packet. The allowable range is 100 to 10000. If a selection is made outside of the allowable range, the message "The value entered is out of Range. The range is 100 - 10000." is displayed (default = 1000)
<b>Use CSU loop codes:</b>	When the Use CSU loop codes is set On, the <i>CellPath</i> 90 loops back when a T1 CSU loop code is received. When turned Off, the <i>CellPath</i> 90 does not loop back when receiving T1 CSU loop codes. The use of CSU loop codes is normally set On (default).

## 4.6.2 DTE1/DTE2 Configuration

The *CellPath* 90 can be equipped with up to four (4) DTE ports. The operating system automatically displays the proper interface corresponding to the port. However, a selection is required for the port with the V.35/RS449/X.21 interface (DTE1 or DTE2). There are two interface options, V.35 and RS449/X.21.



**Figure 4.9 - DTE 1/DTE 2 Configuration Menu**

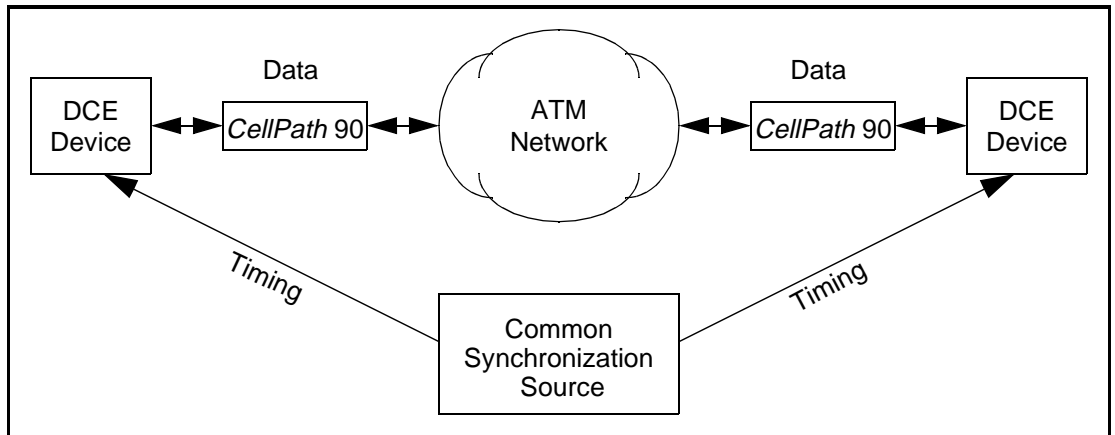
**Interface:** V.35 (default) or RS-449

**Clocking:** SCT, SCT Inverted, SCTE in either Continuous or Gapped mode and FROM DCE in Continuous mode. The default clocking is SCT, Continuous. Refer to *Chapter 2, Description* for information on the various clocking schemes.

Continuous (smooth) clocking should be used when configuring Constant Bit Rate (CBR) type traffic, i.e., video codec equipment.

Gapped clocking should be used when configuring Variable bit Rate (VBR) type traffic, i.e., routers.

FROM DCE clocking requires that the DCE devices connected to the *CellPath 90* are controlled from a common synchronization (clock) source as shown in Figure 4.10. When using FROM DCE clocking, connect the *CellPath 90* to the DCE devices using the DTE to DCE cable described in *Appendix D, Connector Pinouts*.



**Figure 4.10 - Typical FROM DCE Clocking Configuration**

**Rate:** Nx56 or Nx64 = xxxx Kb/s, where N = 1 to 24 at 56 Kb/s or 64 Kb/s and xxxx represents the appropriate data rate in kilo bits per second (Kb/s); organized in a round robin fashion (pressing the <Space-bar> increments through the available choices, the <Backspace> key decrements). If FROM DCE clocking is set, the rate setting is a range of Kb/s starting at 0-64 Kb/s up to 1408-1536 Kb/s in 64 or 128Kb/s increments.



Set the rate to the closest rate, at or above, the true clock rate of the DCE when using FROM DCE clocking. The unit may experience frequent underruns/overruns if the rate is not set correctly.

<b>Protocol:</b>	ATM DXI 1a (Frame relay, 2-byte header, CRC-16); Structured AAL1 CBR (no signaling); Unstructured AAL1 CBR; Raw HDLC, CRC-16 (CEX Mode); and Raw HDLC, CRC-32 (CEX Mode). ATM DXI 1a is the default. Refer to <i>Chapter 2, Description</i> , for information on the various protocols supported on the DTE1 and DTE2 ports.
<b>DTE-present Signal Control:</b>	None (default), RTS and DTR. The signal state of the specified lead is used by the <i>CellPath 90</i> for dynamic bandwidth assignment of CBR traffic. Upon detection of an asserted high signal state, the <i>CellPath 90</i> transmits traffic from this port onto the PVC configured for the port. Upon detection of an idle, or low signal state, the <i>CellPath 90</i> does not transmit traffic from this port onto the assigned PVC. The unused bandwidth is then made available to any of the configured VBR ports.
<b>DTE 1 alarms:</b>	On or Off. When On, and the DTE port is turned off or disconnected the <i>CellPath 90</i> goes into an alarm state. For normal operation DTE 1/2 alarms are set On (default).
<b>Maximum burst size (in bytes):</b>	In burst mode, a packet can contain data which may vary from the minimum of 1500 bytes to the maximum of 65535 bytes and successive packets may have different lengths which can lead to bursty traffic. The recommended default setting is 9232 bytes. If a selection is made outside of the allowable range, the message "Value entered is out of Range. The range is 1500 - 65535" is displayed.
<b>Control lead settings:</b>	The state of the DTE 1/2 control leads are software programmable. Normal, On or Off states can be selected. When Normal is selected the <i>CellPath 90</i> operates these leads per EIA-530A. The On selection always asserts an on state for the selected control lead(s) and Off asserts the off state.

For proper operation it is recommended that all leads be set to Normal (default).

DSR: Normal/Off/On

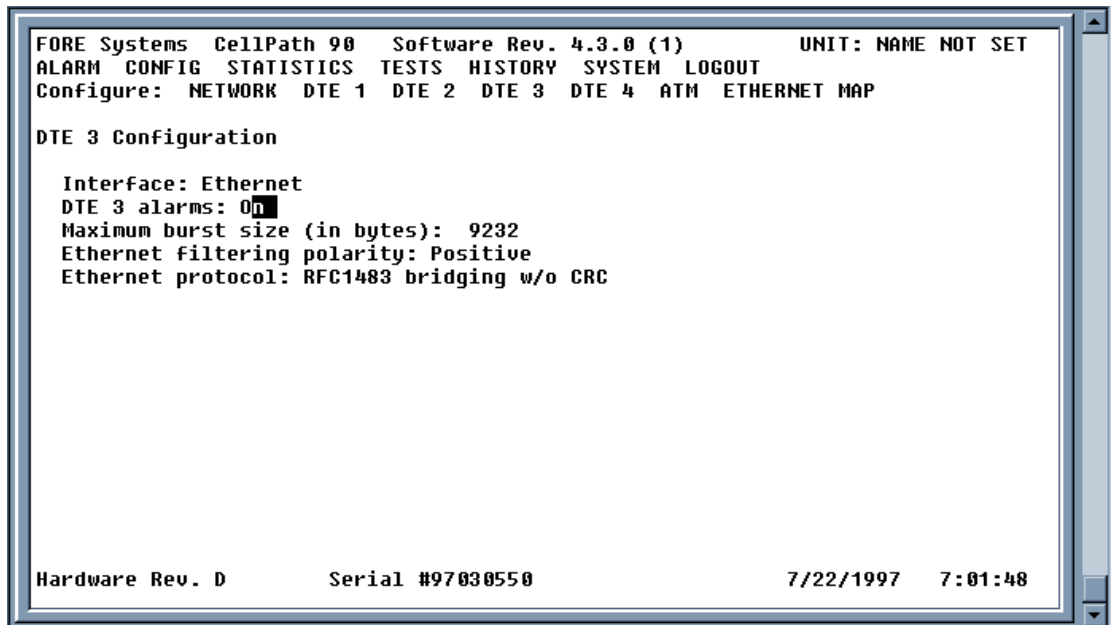
RLSD: Normal/Off/On

CTS: Normal/Off/On

TM: Normal/Off/On

### 4.6.3 DTE3 Configuration

The *CellPath* 90 DTE 3 port is the default Ethernet port. Configurable options for the DTE 3 port are discussed in the following paragraphs. Figure 4.11 displays the DTE 3 Configuration Menu.



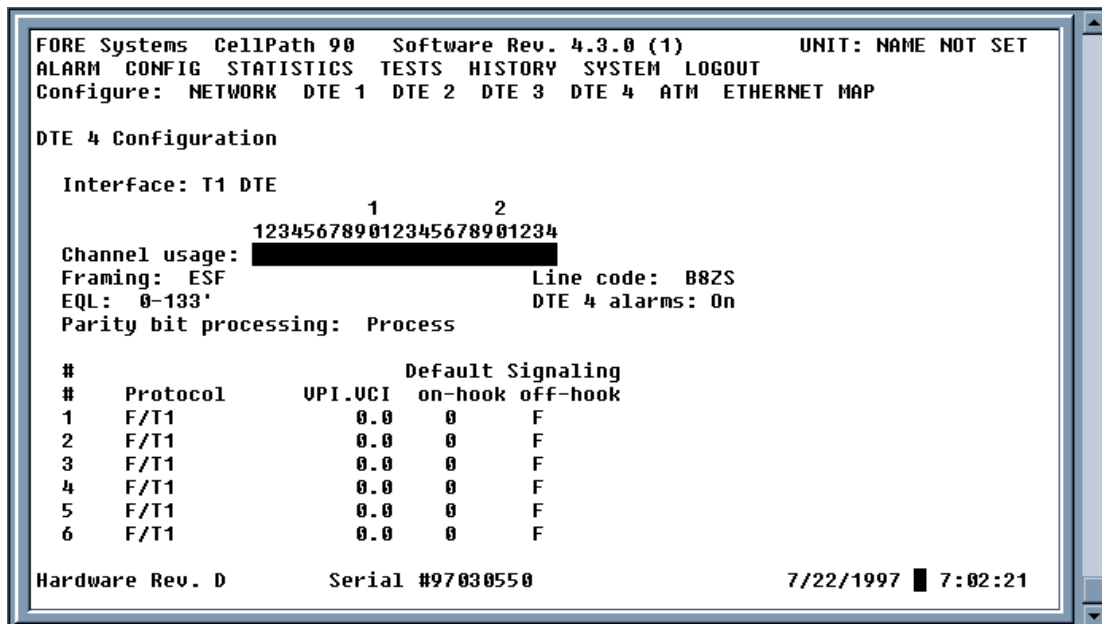
**Figure 4.11 - DTE 3 Configuration Menu**

**Interface:** The default DTE3 interface is Ethernet. There are no options available.

<b>DTE 3 Alarms:</b>	On or Off. When On, and the DTE port is turned off or disconnected the <i>CellPath 90</i> goes into an alarm state. For normal operation DTE 3 alarms are set On (default).
<b>Maximum burst size (in bytes):</b>	In burst mode, a packet can contain data which may vary from the minimum of 1500 bytes to the maximum of 65535 bytes and successive packets may have different lengths which can lead to bursty traffic. The recommended default setting is 9232 bytes. If a selection is made outside of the allowable range, the message "Value entered is out of Range. The range is 1500 - 65535" is displayed.
<b>Ethernet filtering polarity:</b>	Positive or Negative. Positive filtering causes unknown UNI Ethernet frames to be dropped from the network where a negative setting causes unknown UNI Ethernet frames to be sent to the network. Setting the Ethernet filtering polarity to positive conserves total bandwidth to the network. The default is Positive.
<b>Ethernet Protocol:</b>	RFC-1483 bridging w/CRC and w/o CRC. If this option is set w/o CRC, the CRC is stripped and then rebuilt at the Far-End. This option should be set to match the Far-End configuration. The default is w/o CRC.

## 4.6.4 DTE4 Configuration

The *CellPath* 90 DTE 4 port is the default T1 Circuit Emulation Services (CES) port. Configurable options for the DTE 4 port are discussed in the following paragraphs. Figure 4.12 displays the DTE 4 Configuration Menu.



**Figure 4.12 - DTE 4 Configuration Menu**

**Channel usage:** The T1 DTE interface provides a total of 24 bidirectional channels (DS0's), 20 of which are configurable. It is necessary to specify the channels and type of traffic for each channel used. Use the <Space-bar>, or <Backspace> key, to cycle through the available selections of blank (unused) and 1-6. This number corresponds to the bundle selection described below. Use the cursor arrow keys to move horizontally across the Channel usage window.


**NOTE**

Due to ATM overhead, the maximum number of usable channels is 21. Any channels configured over 21 are ignored. Also, if more than one fractional DS0 is selected, the maximum combined number of available channels is reduced to 20 due to unit limitations.

<b>Framing:</b>	Extended Superframe (ESF) or D4 (default ESF).
<b>Line code:</b>	B8ZS or AMI line coding. B8ZS line coding should be selected for an ATM T1 line code setting.
<b>EQL:</b>	<p>EQL (equalization) is the distance between the <i>CellPath</i> 90 and the associated PBX or Channel Bank. The available selections are:</p> <ul style="list-style-type: none"> <li>0-133 feet (default)</li> <li>133-266 feet</li> <li>266-399 feet</li> <li>399-533 feet</li> <li>533-655 feet</li> </ul>
<b>DTE 4 alarms:</b>	On or Off. If set On, when the DTE port is turned off or disconnected the <i>CellPath</i> 90 goes into an alarm state. For normal operation DTE 4 alarms are set On (default).
<b>Parity Bit Processing:</b>	Process or Ignore. The default is to Process the parity bit. Set this option to Process if connecting the DTE4 port to a device supporting AAL1 circuit emulation. Parity bit processing is required if the <i>CellPath</i> 90 is communicating with another <i>CellPath</i> 90 and the operating system of the other <i>CellPath</i> is at a different revision level. Set this option to Ignore if parity errors are encountered.

The following section of the DTE4 menu allows configuring the protocol for each bundle configured in Channel usage above. Each bundle can be set to Fractional T1 with signalling (F/T1 w/sig) or Fractional T1 (F/T1). Additionally, the VPI.VCI value for each configured DS0 can be entered. The # column represents the bundles of associated DS0's selected above.

**Protocol:** F/T1 (Fractional T1) or F/T1 w/sig (Fractional T1 w/Signalling).

F/T1 provides a clear channel without signaling bits. Used in configurations where DTE4 or PBX equipment uses common channel signaling (CCS) (default).

If F/T1 w/sig is selected, ABCD signaling is recovered from the T1 DTE port and sent as a part of the ATM cell payload to the destination. Used in configurations where DTE4 or PBX equipment uses channel associated signaling (CAS).

**VPI.VCI** Enter VPI.VCI value for the respective DTE circuit. This value is used for routing traffic from the T1 Network to the DTE port. The maximum VPI.VCI values are 99.9999, respectively. Refer to *Appendix B, Additional Configuration Information* for information on guidelines and restrictions when assigning VPI.VCI values.

**Default Signaling (on-hook/off-hook)** Specify the on-hook and off-hook voice channel signal conditioning as specified in ITU-T-704. These settings should be set to match the on-/off-hook values of the connected system. The *CellPath 90* default values should be set as '0' on-hook and 'F' off-hook.

## 4.6.5 ATM Configuration

The ATM configuration menu (see Figure 4.13) allows setup of the logical circuits for each DTE port. A maximum of 256 connections are supported per *CellPath 90*. When ATM mode 1a is used (Frame Relay) on the DTE side, the DLCI is translated directly to the appropriate VPI/VCI. The purpose of VPI/VCI in the ATM connection screen is for filtering only.

FORE Systems CellPath 90 Software Rev. 4.3.0 (1) UNIT: NAME NOT SET									
ALARM CONFIG STATISTICS TESTS HISTORY SYSTEM LOGOUT									
Configure: NETWORK DTE 1 DTE 2 DTE 3 DTE 4 ATM ETHERNET MAP									
ATM Connection Configuration <- PREVIOUS NEXT ->									
#	Port	SCR	PCR	Cell drop	Shaping	AAL	UPC/UCC	VPI.VCI	DLCI
1	ILMI	56 Kb/s	56 Kb/s	PCR	On	AAL 5	UCC	0.16	256
2	-	None	None	PCR	On	AAL 5	UCC	0.0	0
3	-	None	None	PCR	On	AAL 5	UCC	0.0	0
4	-	None	None	PCR	On	AAL 5	UCC	0.0	0
5	-	None	None	PCR	On	AAL 5	UCC	0.0	0
6	-	None	None	PCR	On	AAL 5	UCC	0.0	0
7	-	None	None	PCR	On	AAL 5	UCC	0.0	0
8	-	None	None	PCR	On	AAL 5	UCC	0.0	0
9	-	None	None	PCR	On	AAL 5	UCC	0.0	0
10	-	None	None	PCR	On	AAL 5	UCC	0.0	0
11	-	None	None	PCR	On	AAL 5	UCC	0.0	0
12	-	None	None	PCR	On	AAL 5	UCC	0.0	0
13	-	None	None	PCR	On	AAL 5	UCC	0.0	0
14	-	None	None	PCR	On	AAL 5	UCC	0.0	0
15	-	None	None	PCR	On	AAL 5	UCC	0.0	0
16	-	None	None	PCR	On	AAL 5	UCC	0.0	0
Hardware Rev. D Serial #97030550 7/22/1997 7:02:54									

Figure 4.13 - ATM Configuration Menu

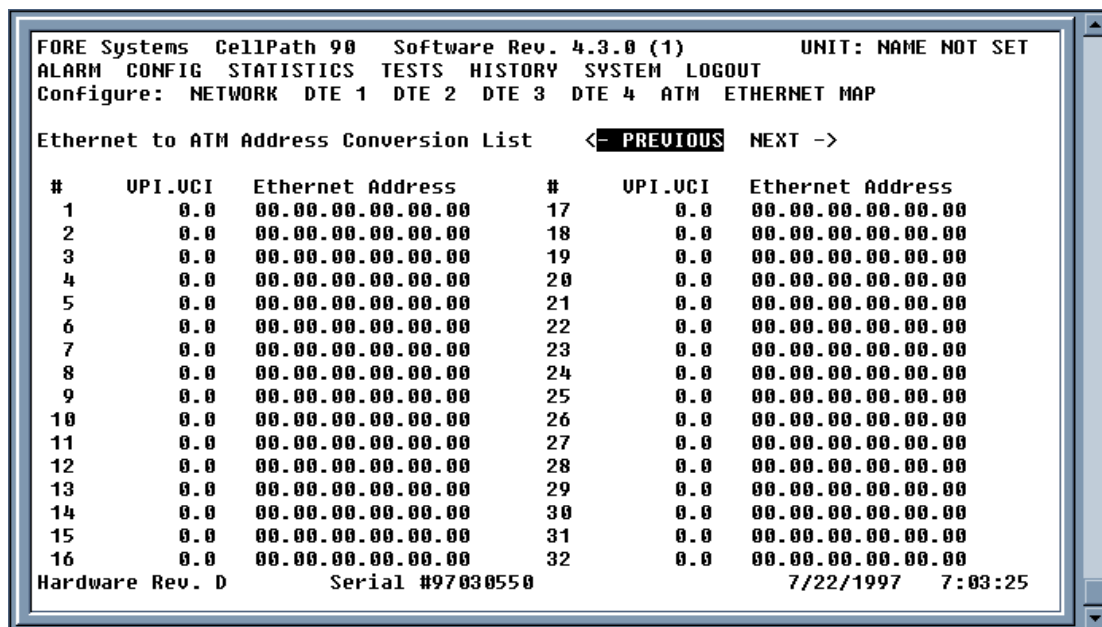
- # Corresponds to ATM connection 1 through 256. ATM connection 1 is set at the factory to Interim Local Management Interface (ILMI) with an SCR rate of 128 Kb/s, PCR rate of 672 Kb/s and a VPI.VCI of 0.16. VPI.VCI 0.16 is reserved for network signaling information.
- Port SNMP, ILMI, 1 through 4 corresponding to the physical port on the *CellPath* 90, or '-' unused. There are a possible 256 ATM connections which can be configured in this menu. Moving the cursor to <- PREVIOUS or NEXT -> allows scrolling through all possible ATM connections. A setting of ILMI allows the *CellPath* 90 to be discovered from an ATM switch and its Network Service Access Point (NSAP) address (see Figure 4.23) read. If SNMP is set, it is necessary to set the IP addresses for the SNMP connection in the SYSTEM-->INTERFACES menu (Figure 4.23), explained later in this chapter.

<b>SCR</b>	Set the same as the rate on a typical DTE configuration. The DTE rate may be set higher than the sustained rate for bursty type (VBR) traffic. If configured for Constant Bit Rate (CBR) traffic, then the sustained rate and peak rate are the same as the DTE rate. The available SCR options range from 56Kb/s through 1344 Kb/s.
<b>PCR</b>	Must be higher than or equal to the SCR. If the DTE traffic is higher than the SCR but less than or equal to the PCR, the <i>CellPath</i> 90 sets the CLP value to 1. If the DTE traffic is greater than the PCR, the entire packet is dropped by the <i>CellPath</i> 90 (i.e., early packet discard). The values available are the same as those specified in SCR.
<b>Cell drop</b>	Tag, Drop, or do nothing with cells that exceed either the SCR or PCR for the connection. The default is to tag cells if the SCR is exceeded and to drop cells if the PCR is exceeded. If set to Off, nothing is done with those cells that exceed either the assigned SCR or PCR. The default is PCR.
<b>Shaping</b>	On or Off. When On, the <i>CellPath</i> 90 shapes the DTE traffic towards the ATM network using a dual leaky bucket algorithm (default is On).
<b>AAL</b>	AAL1 or AAL5. AAL1 is supported for Constant Bit Rate (CBR) traffic, and AAL5 for Variable Bit Rate (VBR) traffic. When setting AAL1 (CBR), the SCR and PCR are preset and 'See DTE rate' is displayed. The DTE rate is the rate set in the DTE1 or DTE2 configuration menu.
<b>VPC/VCC:</b>	VPC or VCC (default is VCC).
<b>VPI.VCI:</b>	Enter the appropriate VPI/VCI value for the assigned DTE circuit. The VPI/VCI value is used for routing the traffic from the T1 Network to/from the assigned DTE port. The maximum VPI.VCI values are 99.9999, respectively. Refer to <i>Appendix B, Additional Configuration Information</i> for information on guidelines and restrictions when assigning VPI.VCI values.

**DLCI** A Data Link Connection Identifier (DLCI) value can be entered which automatically calculates and enters the appropriate VPI.VCI. Conversely, entering a VPI.VCI value calculates and enters the appropriate DLCI in this field. This field can be overwritten in the event the default DLCI value if manual mapping is required. To modify the default value, move to this field and enter the required value. Pressing the <Enter> key saves the value. Refer to *APPENDIX C, Converting DFAs or DLCIs and VPI/VCI*s for more information on DFA or DLCI and VPI.VCI mappings.

## 4.6.6 Ethernet Map

The Ethernet Map screen (Figure 4.14) provides a VPI.VCI to Ethernet MAC address mapping, on a per ATM channel basis, of discovered addresses on the ATM network. A maximum of 256 connections *CellPath* 90 can be viewed. The most recent 256 entries are maintained in the Ethernet Map. In the event that more than 256 entries are accessed, the oldest address is dropped. This table is an internal table used for diagnostic purposes. Previous and Next display the previous or next 16 entries.



FORE Systems CellPath 90 Software Rev. 4.3.0 (1) UNIT: NAME NOT SET					
ALARM CONFIG STATISTICS TESTS HISTORY SYSTEM LOGOUT					
Configure: NETWORK DTE 1 DTE 2 DTE 3 DTE 4 ATM ETHERNET MAP					
Ethernet to ATM Address Conversion List <- PREVIOUS NEXT ->					
#	UPI.VCI	Ethernet Address	#	UPI.VCI	Ethernet Address
1	0.0	00.00.00.00.00.00	17	0.0	00.00.00.00.00.00
2	0.0	00.00.00.00.00.00	18	0.0	00.00.00.00.00.00
3	0.0	00.00.00.00.00.00	19	0.0	00.00.00.00.00.00
4	0.0	00.00.00.00.00.00	20	0.0	00.00.00.00.00.00
5	0.0	00.00.00.00.00.00	21	0.0	00.00.00.00.00.00
6	0.0	00.00.00.00.00.00	22	0.0	00.00.00.00.00.00
7	0.0	00.00.00.00.00.00	23	0.0	00.00.00.00.00.00
8	0.0	00.00.00.00.00.00	24	0.0	00.00.00.00.00.00
9	0.0	00.00.00.00.00.00	25	0.0	00.00.00.00.00.00
10	0.0	00.00.00.00.00.00	26	0.0	00.00.00.00.00.00
11	0.0	00.00.00.00.00.00	27	0.0	00.00.00.00.00.00
12	0.0	00.00.00.00.00.00	28	0.0	00.00.00.00.00.00
13	0.0	00.00.00.00.00.00	29	0.0	00.00.00.00.00.00
14	0.0	00.00.00.00.00.00	30	0.0	00.00.00.00.00.00
15	0.0	00.00.00.00.00.00	31	0.0	00.00.00.00.00.00
16	0.0	00.00.00.00.00.00	32	0.0	00.00.00.00.00.00

Hardware Rev. D Serial #97030550 7/22/1997 7:03:25

Figure 4.14 - Ethernet Map Screen

## 4.7 Statistics Menu

The Statistics menu (see Figure 4.15) provides access to the DS1 (Network T1) statistics and ATM counters. In addition, options are provided to clear and initialize all statistical counters. Once in the statistics menu, select the desired item by moving the cursor to the item, then press the <Enter> key to view the related statistics.

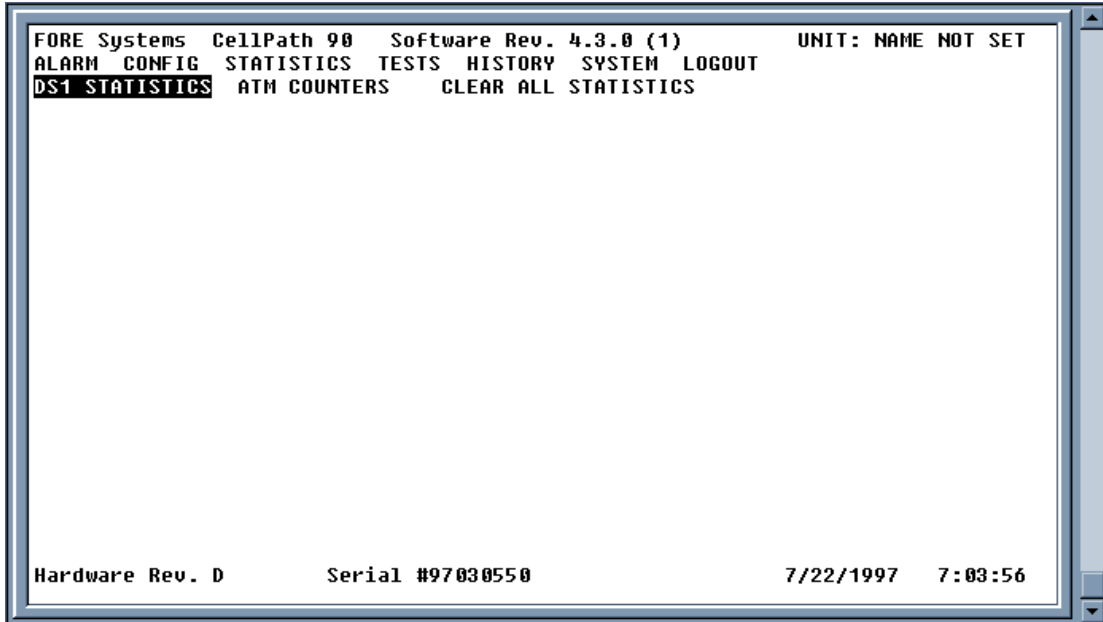


Figure 4.15 - STATISTICS Main Menu

### 4.7.1 DS1 Statistics Screen

The DS1 statistics screen (Figure 4.16) displays T1 Network performance statistics. These statistics are accumulated in fifteen minute intervals. Statistics of the current, total and up to the last 24 hours of operation (96 fifteen minute intervals) are stored by the agent. Fewer than 96 intervals of data are stored if the agent has been functioning for less than 24 hours. Refer to *Chapter 2, Description* for descriptions of the *Performance Defects* and *Error Events* displayed in this screen. Selecting <- PREVIOUS or NEXT -> cycles through the available intervals. CLEAR DS1 STATISTICS provides a facility to clear (reset to 0) the statistics database.

#### NOTE

All Network Statistics and ATM Counters are cleared when the unit is powered off.

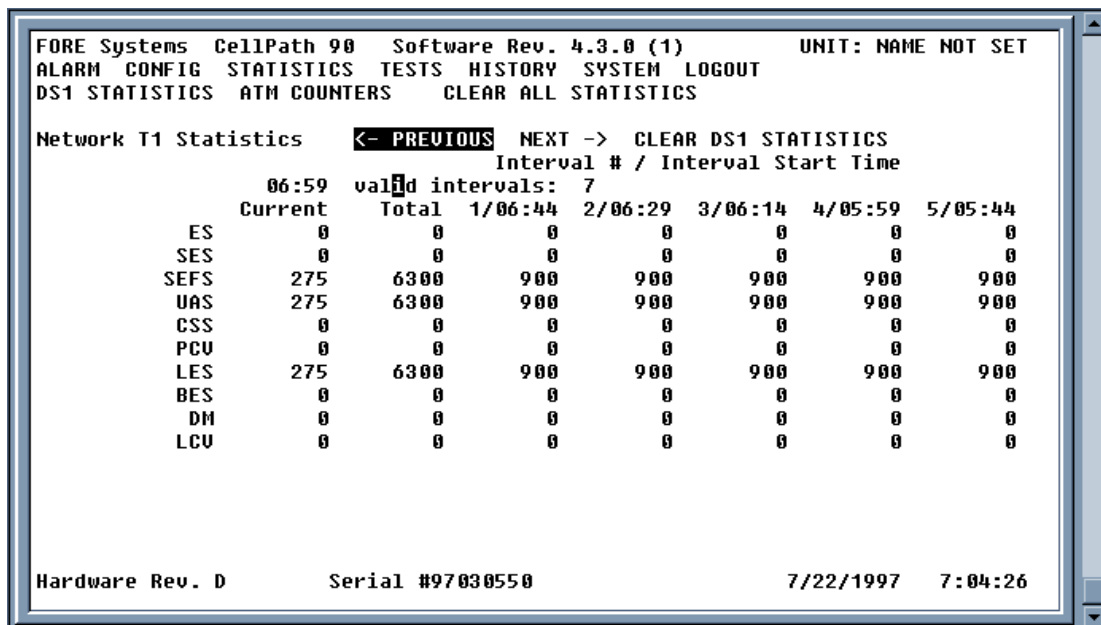


Figure 4.16 - Network T1 Statistics Screen

- Errored Seconds (ES)
- Severely Errored Seconds (SES)
- Severely Errored Framing Seconds (SEFS)
- Unavailable Seconds (UAS)
- Controlled Slip Seconds (CSS)
- Path Code Violation (PCV)
- Line Errored Seconds (LES)
- Bursty Errored Seconds (BES)
- Degraded Minutes (DM)
- Line Code Violation (LCV)

In order to view specific intervals, position the cursor on <-PREVIOUS or NEXT -> and press the space bar until the desired interval is visible.

## 4.7.2 ATM Counters Screen

ATM Counter statistics are provided as shown in Figure 4.17. The statistics display the number of ATM cells sent or received as explained below. CLEAR ATM COUNTERS provides a facility to clear (reset to 0) current ATM counter values.

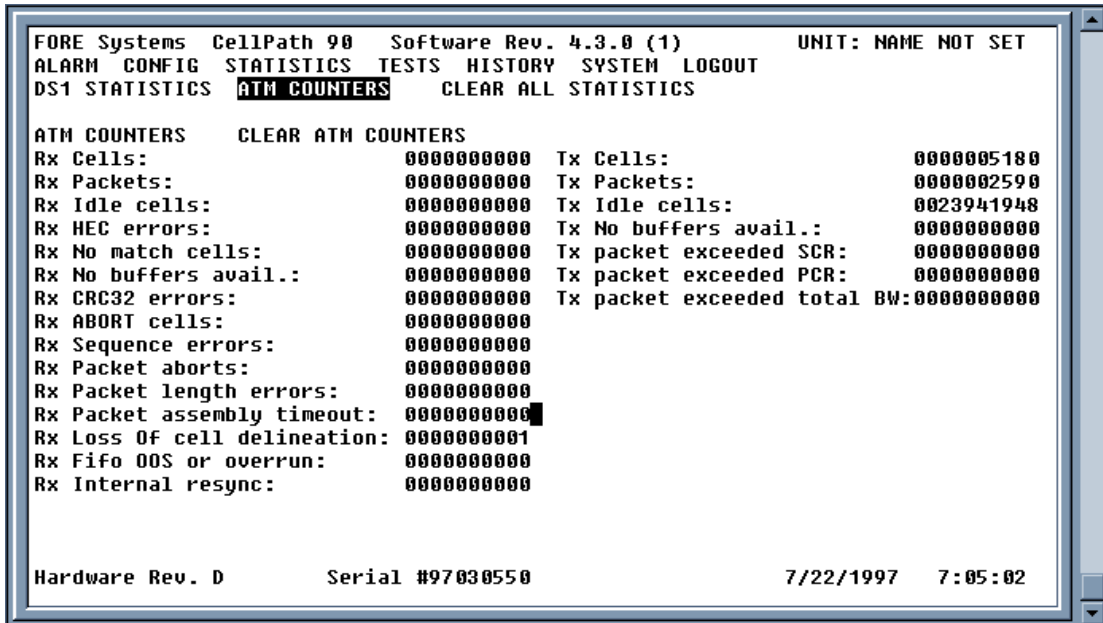


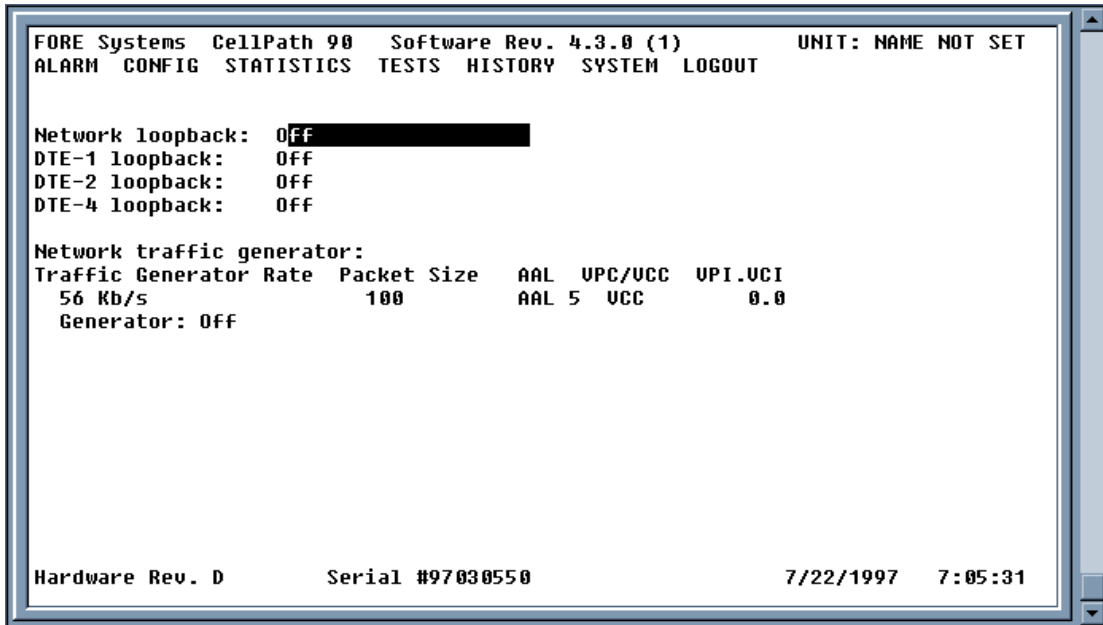
Figure 4.17 - ATM Counters Screen

<b>Rx Cells:</b>	Total number of cells received from the ATM network. This counter does not count Idle cells.
<b>Rx Packets:</b>	Total number of packets received from the ATM network.
<b>Rx Idle cells:</b>	Total number of Idle cells received from the ATM network.
<b>Rx HEC errors:</b>	Total number of HEC errors.
<b>Rx No match cells:</b>	Total number of received cells which did not match the programmed VPI/VCI.
<b>Rx No buffers avail.:</b>	If no receive buffer is available the count increments per each incident.

<b>Rx CRC32 errors:</b>	Count of CRC32 errors detected by the receive CRC verification circuitry.
<b>Rx ABORT cells:</b>	Count of all aborted received cells.
<b>Rx Sequence errors:</b>	AAL1 type traffic receive sequence counter, if there is a sequence count, incremented with each sequence error received.
<b>Rx Packet aborts:</b>	If for any reason the <i>CellPath</i> 90 terminates the assembly of the packets received from the network, discards the bad packet, and increments this counter.
<b>Rx Packet length errors:</b>	If <i>CellPath</i> 90 detects an error with packet length, it discards the packet and increments this count.
<b>Rx Packet assembly timeout:</b>	Time allowed for assembly of received packets has elapsed.
<b>Rx Loss Of cell delineation:</b>	Under normal conditions (when network T1 line is not in an Alarm state), and the <i>CellPath</i> 90 loses Cell delineation synchronization, it increments this count.
<b>Rx Fifo OOS or overrun:</b>	Total number of FIFO overruns.
<b>Rx Internal resync:</b>	Total number of clock resynchs.
<b>Tx Cells:</b>	Total number of cells transmitted to the ATM network. Idle cells are not included.
<b>Tx Packets:</b>	Total number of packets transmitted to the ATM network.
<b>Tx Idle cells:</b>	Total number of idle cells transmitted to the T1 network.
<b>Tx No buffers avail.:</b>	Transmit buffers are full.
<b>Tx packet exceeded SCR:</b>	Transmit packet has exceeded the sustainable cell rate.
<b>Tx packet exceeded PCR:</b>	Transmit packet has exceeded the peak cell rate.
<b>Tx packet exceeded total BW:</b>	Size of the transmitted packet has exceeded the total bandwidth allowed.

## 4.8 Tests Menu

The test menu (Figure 4.18) provides access to test parameters. Enter the tests menu by selecting TESTS at the top level menu.



**Figure 4.18 - TESTS Menu**

**Network loopback:** Off: Loopback testing is not available (default)

*Line - to network:* Loopback is performed at the Line Interface Unit towards the network.

*Payload - to network:* Loopback is performed at the Framer interface towards the network.

*Line - to DTE:* Loopback is performed at the Line Interface Unit towards the DTE.

<b>DTE-1 loopback:</b>	Off: Loopback is not configured (default)  Loop both directions: Loopback is performed both toward the ATM network and the DTE.
<b>DTE-2 loopback:</b>	Off: Loopback is not configured (default)  Loop both directions: Loopback is performed both toward the ATM network and the DTE.
<b>DTE-4 loopback:</b>	Off: Loopback is not configured (default)  DTE to network: Loopback is performed toward the ATM network.  DTE to DTE: Loopback is performed toward the DTE.

Network traffic generator options are:

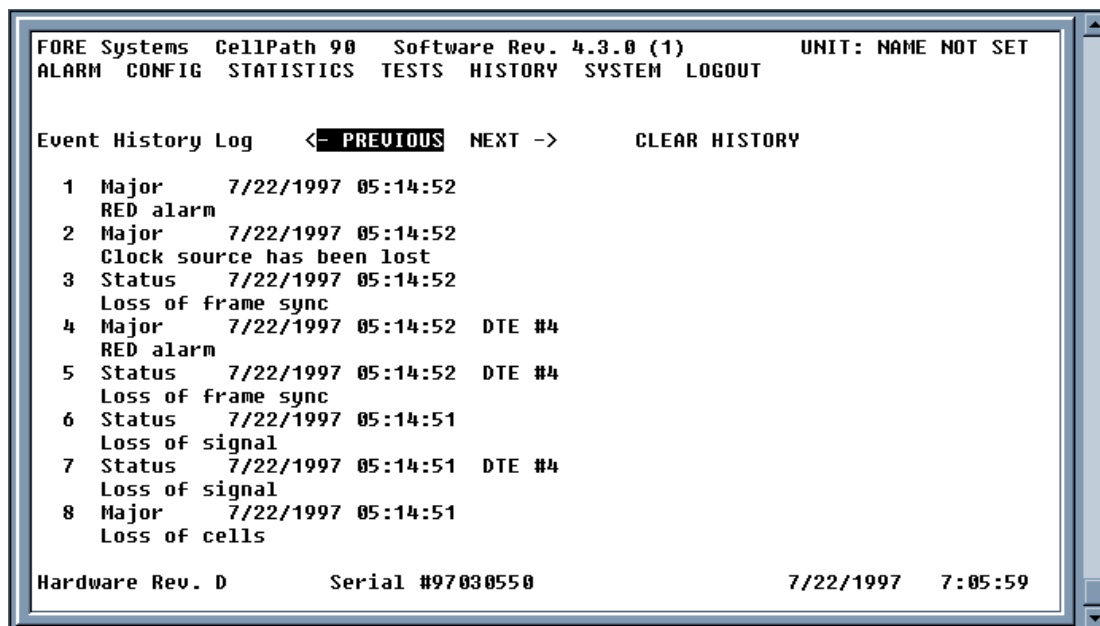
<b>Traffic Generator Rate:</b>	56 Kb/s through 1344 Kb/s. (Refer to 4.6.5, <i>ATM Configuration</i> for a detailed description of these values).
<b>Packet Size</b>	Required entry for the packet size, the recommended packet size is 9188 bytes. The available range is 32 to 9188 bytes. The default is 100.
<b>AAL</b>	Set to AAL5. No options are available.
<b>VPC/VCC</b>	VPC or VCC (default is VCC)
<b>VPI.VCI</b>	Applicable VPI.VCI to be tested.
<b>Generator:</b>	Off or generate traffic to network (default Off). The traffic generator is turned Off when power to the <i>CellPath</i> unit is cycled.

## 4.9 History Screen

The history screen (Figure 4.19) provides a log of all alarms that have occurred since the unit was last powered on. The last 100 alarms are maintained in the history file.

### NOTE

The History screen is cleared when the unit is powered off.



**Figure 4.19 - HISTORY Screen**

To view a specific alarm, position the cursor on <-PREVIOUS or NEXT-> and press the space bar until the desired alarm is visible.

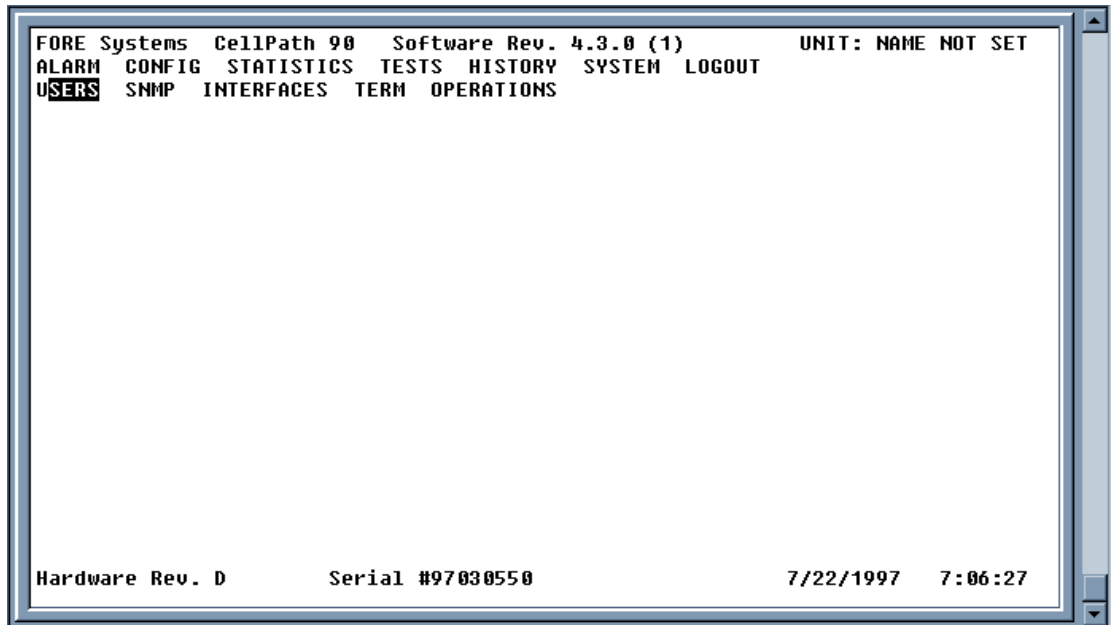
The first column displays the date and time of the alarm. If the alarm clears then the second column appears with the date and time the alarm was cleared.

To manually clear the history file, position the cursor on CLEAR HISTORY and press the <Enter> key.

## 4.10 System Menu

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The system menu (Figure 4.20) provides system related menu items and their parameters. These items are USERS, SNMP, INTERFACES, TERMinal and OPERATIONS and are described in the following paragraphs.



**Figure 4.20 - SYSTEM Menu**

### 4.10.1 Users

The USERS menu (Figure 4.21) contains a list of assigned user names, associated password and security level. User names and passwords, as well as the security level, are normally setup by the system administrator. The options available from this menu are:

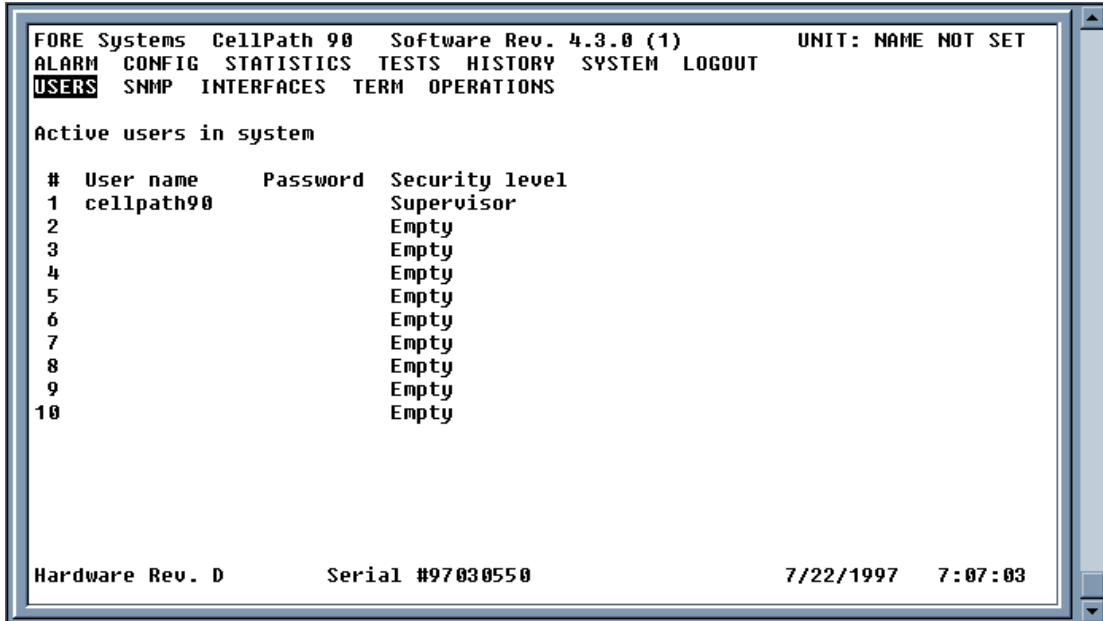


Figure 4.21 - USERS Menu

- User name** List of active users (up to 10) allowed access to the system. To add a user, position the cursor on the next available user name field and then enter the name to be assigned the user. Press the <Enter> key to save the User Name. Entries can be up to 12 alphanumeric characters in length. **Usernames are case sensitive.** The *CellPath* 90 is shipped with a default username of *cellpath90*.
- Password** Associated password for the respective user. To enter a password, position the cursor on the appropriate password field and then enter the password to be assigned. Press the <Enter> key to save the assigned Password. Entries can be up to 8 alpha-numeric characters in length. **Passwords are case sensitive.** All passwords are displayed as asterisks.

<b>Security level</b>	<p>Security levels should be assigned to reflect the desired access level of each user. The &lt;Space-bar&gt; or &lt;Backspace&gt; keys cycle through the available options, which are:</p> <p><i>Empty</i> Used to temporarily disable a users access.</p> <p><i>Display</i> Users assigned this security level have view only access of all menus with the exception of ALARMS and SYSTEM; they cannot change configuration options, perform testing, or clear statistics.</p> <p><i>Maintenance</i> Users assigned this security level can perform testing of the <i>CellPath 90</i>; but cannot change or add users or provision the equipment.</p> <p><i>Provisioning</i> Users assigned this security level can access configuration options, clear statistics and perform testing. They are restricted access to the SYSTEM menu.</p> <p><i>Supervisor</i> Users assigned this password can access all functions in the <i>CellPath 90</i> menu system. They can add/remove new users, assign security levels, configure port parameters, and perform testing of the unit. This is the highest user level that can be assigned.</p>
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## 4.10.2 SNMP Menu

The SNMP menu provides an ability to modify SNMP related parameters. These parameters include the Read, Write, and Trap community strings. The SNMP menu uses password-like community strings to determine if an SNMP packet should be processed. The *CellPath 90* uses standard default SNMP community strings which can be changed if SNMP access is to be restricted. SNMP community strings are configured in the SYSTEM->SNMP menu. To access this screen (Figure 4.22) select SYSTEM followed by SNMP.

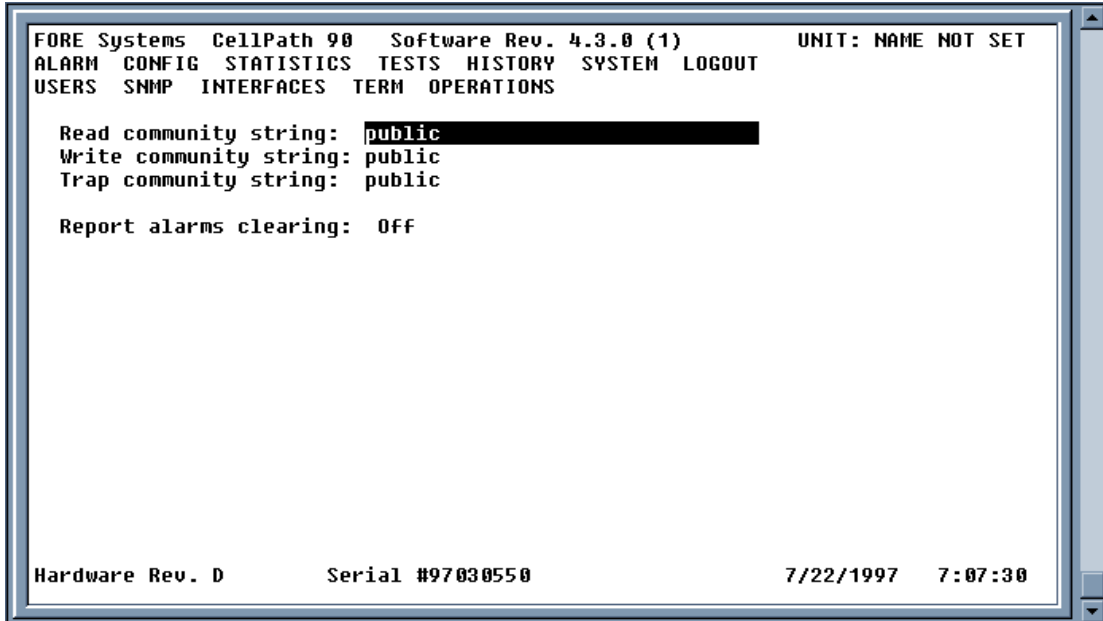


Figure 4.22 - SNMP Menu

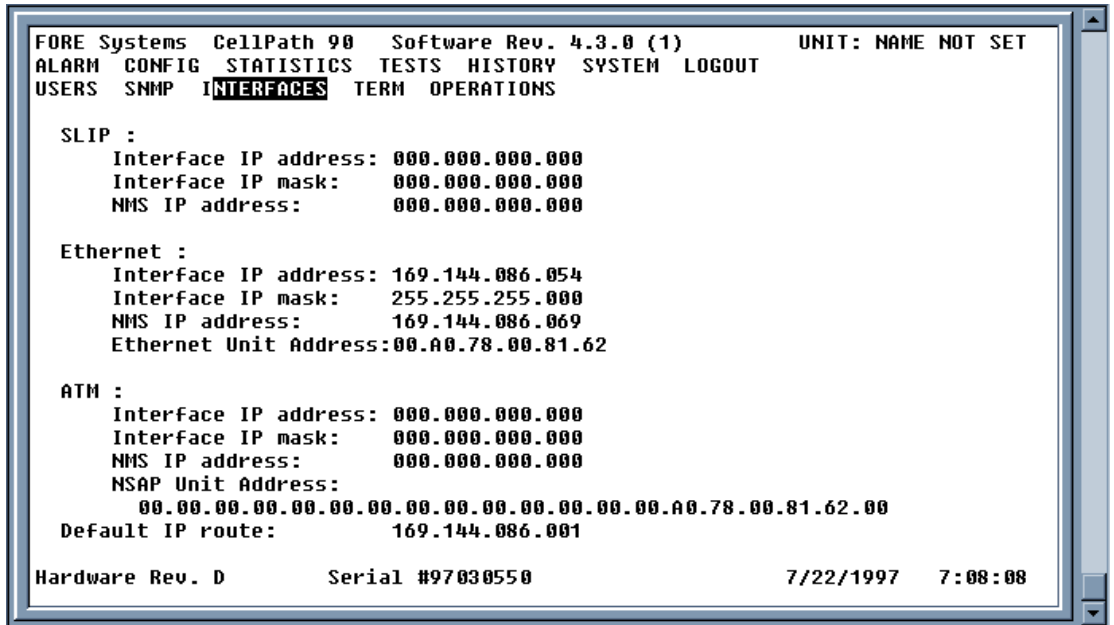
- Read community string:** Allowable 31 character SNMP Read community string.
- Write community string:** Allowable 31 characters SNMP Write community string.
- Trap community string:** Allowable 31 character SNMP Trap community string.
- Report alarms clearing:** Setting this option to On sends a notification to the SNMP NMS for trap reporting. The default is Off.

### 4.10.3 Interfaces Screen

The INTERFACES screen (Figure 4.23) provides the ability to configure SLIP, Ethernet, and/or ATM Internet Protocol (IP) addresses and masks. These settings are required when configuring remote access through the Network Management Station (NMS) port, the Ethernet port (DTE3) or SNMP (ATM port or TERM) connectivity.

**NOTE**

Unique subnets are required when entering IP addresses. Refer to *Appendix B, Additional Configuration Information* for additional information on configuring IP addresses.



**Figure 4.23 - Interfaces Screen**

- SLIP:** Interface IP address: IP address of the unit over the NMS port.
- Interface IP mask: IP mask of the unit over the NMS port.
- NMS IP address: IP address of the NMS the unit responds to over the NMS port.

**Ethernet:** Interface IP address IP address of the unit over the Ethernet port.

Interface IP mask IP mask of the unit over the Ethernet port.

NMS IP address: IP address of the NMS the unit responds to over the Ethernet port.

Ethernet Unit Address: This is a unique Ethernet MAC layer address of the unit. This entry is set at the factory and cannot be changed by the user.

**ATM:** Interface IP address: IP address of the unit over the ATM port.

Interface IP mask: IP mask of the unit over the ATM port.

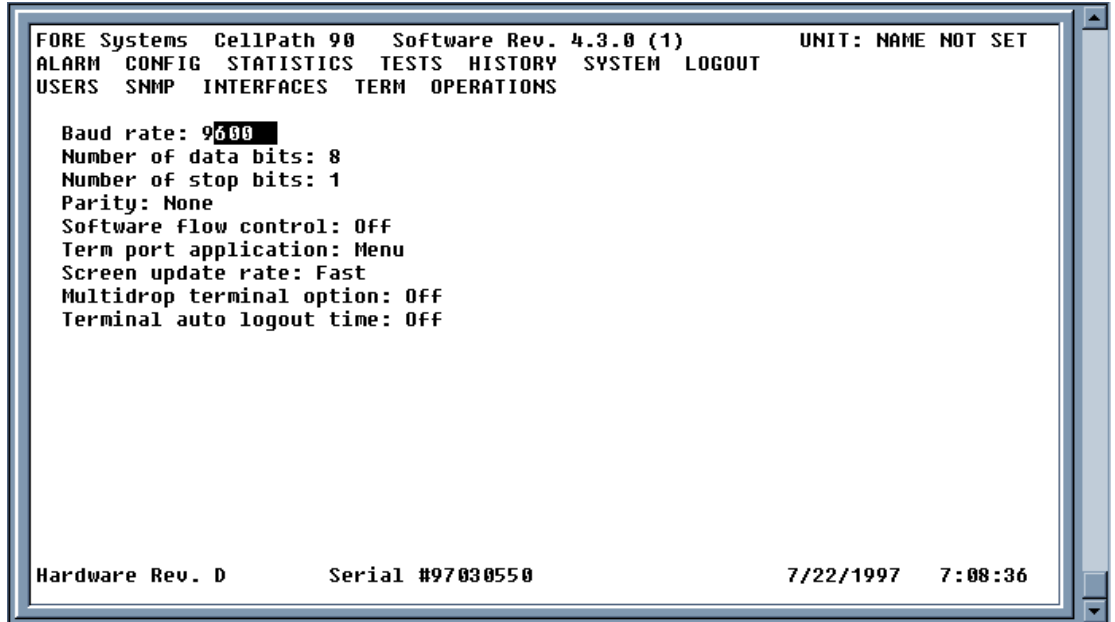
NMS IP address: IP address of the NMS the unit responds to over the ATM port.

NSAP Unit Address: This is a unique ATM NSAP address established between the unit and the connected switch. This entry is preset and cannot be changed by the user. Refer to Figure 4.13, the first ATM connection defaults to ILMI on VPI.VCI 0.16. Once the unit is connected to an ATM switch the NSAP Unit Address is returned from the ATM network.

**Default IP route:** IP address of the default router to which the unit is connected.

#### 4.10.4 TERM Menu

The TERMinal menu (see Figure 4.24) provides the ability to override the front panel DIP switch settings of the *CellPath* 90 communications to terminal or SNMP management stations.



**Figure 4.24 - TERMinal Menu**

The front panel DIP switch settings can be changed through the TERMinal menu, from an SNMP Management station connected to the NMS port, or via an active Telnet session. Note that the baud rate is limited to 19,200 bps on the front panel, however, the baud rate can be increased to 115,200 through both the TERM menu and the SNMP Manager. Also note that the baud rate that is actually executed is the one last set in chronological order whether from the front panel, the TERMinal menu or the SNMP Manager.



All of the TERM values are read from the front panel DIP switches. Changing a switch position affects the contents of this menu and potentially disrupt communications between the *CellPath* unit and connected NMS.

<b>Baud rate:</b>	Baud rate available from 300, 1200, 2400, 4800, 9600, 19200, 38400, 57600 or 115200 bps.
<b>Number of data bits:</b>	7 or 8
<b>Number of stop bits:</b>	1 or 2

<b>Parity:</b>	None, Even or Odd
<b>Software flow control:</b>	Off or On
<b>Term port application:</b>	Menu or SNMP



If SNMP is selected as the Term port application it is necessary to place front panel DIP switch 1 to Off (down). The unit can now be accessed from an SNMP management station. If it becomes necessary to reacquire the unit from the terminal interface, set DIP switch 1 On (up). Control is then returned to the terminal interface.

<b>Screen update rate:</b>	Off, Slow, Medium or Fast
<b>Multidrop terminal option:</b>	Off or On. Before turning this option on, ensure that a unit name is assigned to each <i>CellPath</i> 90.



If Multidrop is set On the system prompts for the unit name during the login sequence. If a unit name is not entered during the login sequence logins are not allowed.

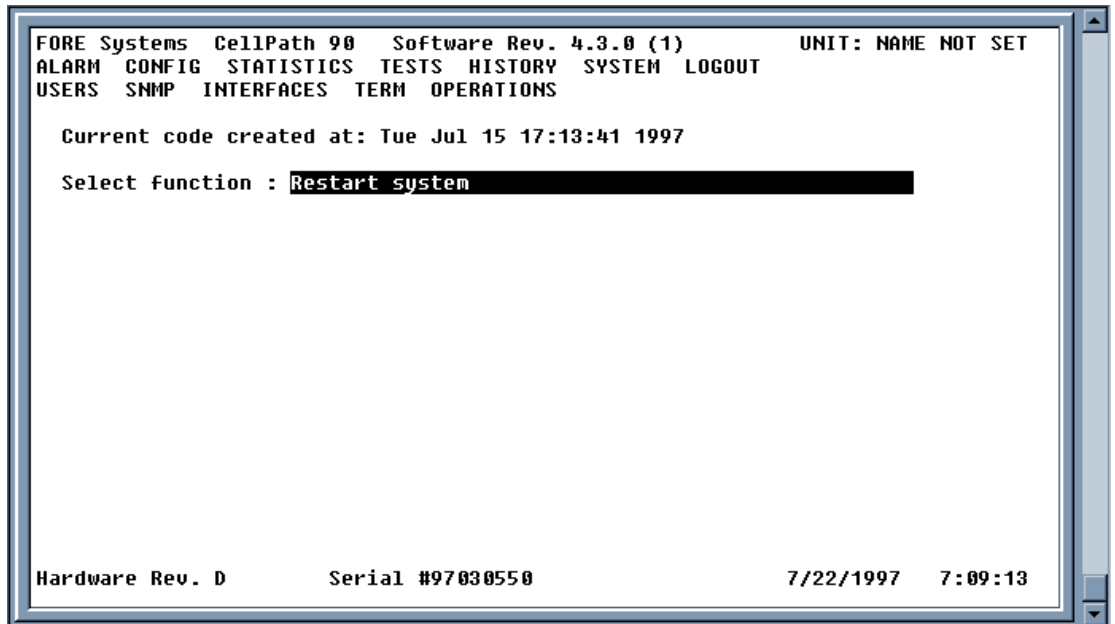
<b>Terminal auto logout time:</b>	Off, 5, 15, or 30 minutes. Logs out of the configured <i>CellPath</i> 90 interface if no activity occurs in the allotted time frame.
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## 4.10.5 Operations Menu

The Operations Menu (Figure 4.25) provides the user with the capability of performing various system level functions. The *CellPath* 90 memory system consists of non-volatile Random Access Memory (RAM) and electrically erasable programmable read only memory (EEPROM). Additionally, the *CellPath* 90 EEPROM is divided into three sections:

- Boot section, containing the Boot code.
- Operating/Application section, containing the operating system and application software.
- Data Base, containing the *CellPath* 90 data base.

Following power up, operating system and application software is loaded into RAM from EEPROM and the microprocessor operates out of RAM.



**Figure 4.25 - OPERATIONS Menu**

The following system level functions can be selected from the OPERATIONS menu:

<b>Restart system</b>	Soft reset. Loads newly downloaded software as the active operating system.
<b>Erase database in nonvolatile storage and restart</b>	Erases the configuration data base and replaces it with the factory defaults.
<b>Rewrite running code to nonvolatile storage</b>	Copies the software program running in RAM into non-volatile memory.
<b>Download new code</b>	Allows downloading of new software into the <i>CellPath 90</i> flash memory.

**NOTE**

The above operations all contain a built-in time-out period. If the user does not respond to a prompt in the allotted time frame the message "Not confirmed. Exiting..." is displayed and the user must re-initiate the operation.

## 4.11 Erasing the *CellPath* 90 Configuration

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The following procedure describes the steps required to erase the *CellPath* 90 configuration database.

**NOTE**

The following steps erase ALL configuration information and the *CellPath* 90 is reset to the factory defaults. Before proceeding, ensure that any configuration information that needs to be retained is copied to facilitate a quicker reconfiguration of the *CellPath* 90.

1. Log onto the *CellPath* 90.
2. At the MAIN Menu select SYSTEM and press the <Enter> key.
3. At the SYSTEM Menu select OPERATIONS and press the <Enter> key.
4. Using the space-bar, select "Erase database in nonvolatile storage and restart" and press the <Enter> key.
5. The system responds with:  

```
<<<<<<<<<< Please type the word EraseDataBase followed by <CR>.
```
6. Enter EraseDataBase and press the <Enter> key.
7. The system responds with:  

```
Erasing database...
```
8. The current *CellPath* 90 configuration database settings are erased and reset to the factory defaults.
9. The system is restarted and responds with the login prompt.

## 4.12 Upgrading *CellPath* 90 Software

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The *CellPath* 90 operating system can be upgraded in a number of ways; 1) through the SYSTEM->OPERATIONS menu, 2) the BOOTLOADER menu, or through TFTP. Regardless of the upgrade method used, it is necessary to acquire the latest software from FORE Systems TAC. Additionally, a TFTP operation can be executed that can save the *CellPath* 90 configuration database to a host system. The following paragraphs outline the procedures necessary to upgrade the *CellPath* 90 operating system software. Following the TFTP procedure is a procedure to retrieve the *CellPath* 90 configuration database.

### 4.12.1 Downloading via FTP

FORE Systems, Inc. posts upgrades to *CellPath* 90 system software on the FORE ftp site. The following procedure explains how to obtain the latest *CellPath* 90 software.

1. Log onto FORE Systems, Inc. ftp site  
**ftp ftp.fore.com**
2. When prompted for a username, enter  
**anonymous**
3. When prompted for a password, enter  
**guest@fore.com**  
or (if a valid FORE Systems eMail account exists)  
**username@fore.com**
4. Change directory to priv/release/sunny  
**cd priv/release/sunny**
5. Ensure that the transfer mode is set to binary by entering.  
**binary**
6. Use the ftp get command to transfer the software.  
**get filename**

where xxxx specifies the software release level. Refer to Table 4.1 to determine which *filename* to download.

**Table 4.1 - CellPath 90 Filenames**

Filename	Contents	Description
mainxxxx.msr	Main code and bootloader	Complete operating system with bootloader. This file should be used when performing a complete upgrade of the unit. <i>See 4.12.2, Operating System Download Procedure</i> Download time is approximately 15 minutes.
atmxxxx.msr	Main code only	Operating system only. This file should be used if upgrading the operating system only via Telnet or the User Interface. <i>See 4.12.2, Operating System Download Procedure</i> Download time is approximately 15 minutes.
atmxxxx.bin	TFTP binary file	Binary file of the operating system only. This file should be used if upgrading the operating system only via TFTP. <i>See 4.13.2, Downloading via TFTP</i> Download time is approximately 9 seconds.
CellPath90	Internal Operating System	Filename associated with the internal <i>CellPath 90</i> operating system. Use this filename when using tftp put to upload the operating system. <i>See 4.13.2, Downloading via TFTP</i>
CellPath90_DB	Configuration Database	Filename associated with the internal <i>CellPath 90</i> configuration database. Use this filename when using tftp to get or put a CellPath 90 database. <i>See 4.13.3, Saving Configuration Database via TFTP and 4.13.4, Restoring Configuration Database via TFTP</i>



When the transfer starts, the screen displays whether an ASCII or Binary transfer is taking place. Ensure that the message indicates Binary. In the event that Binary is not indicated, repeat steps 5 and 6. If more than one attempt is made, the second, or subsequent, transfer creates an ***filename.m~1*** file. Ensure that the latest file is used when performing the following procedure.

## 4.12.2 Operating System Download Procedure

The following procedure steps through downloading the operating system through the SYSTEM->OPERATIONS menu selection.

1. Setup terminal software to 9600 baud.
2. Set *CellPath* 90 SW6 up and SW7 down - 9600 baud.
3. Log onto the *CellPath* 90.
4. At the MAIN Menu select System and press the <Enter> key.
5. At the SYSTEM Menu select Operations and press the <Enter> key.
6. Using the <Space-bar>, select "Download new code" and press the <Enter> key.
7. The system responds with:

<<<<<<<<<< Please type the word systemload followed by <CR>.

8. Enter systemload and press the <Enter> key.

9. The system responds with:

Starting Download..."

Begin transmission of Motorola S-records.



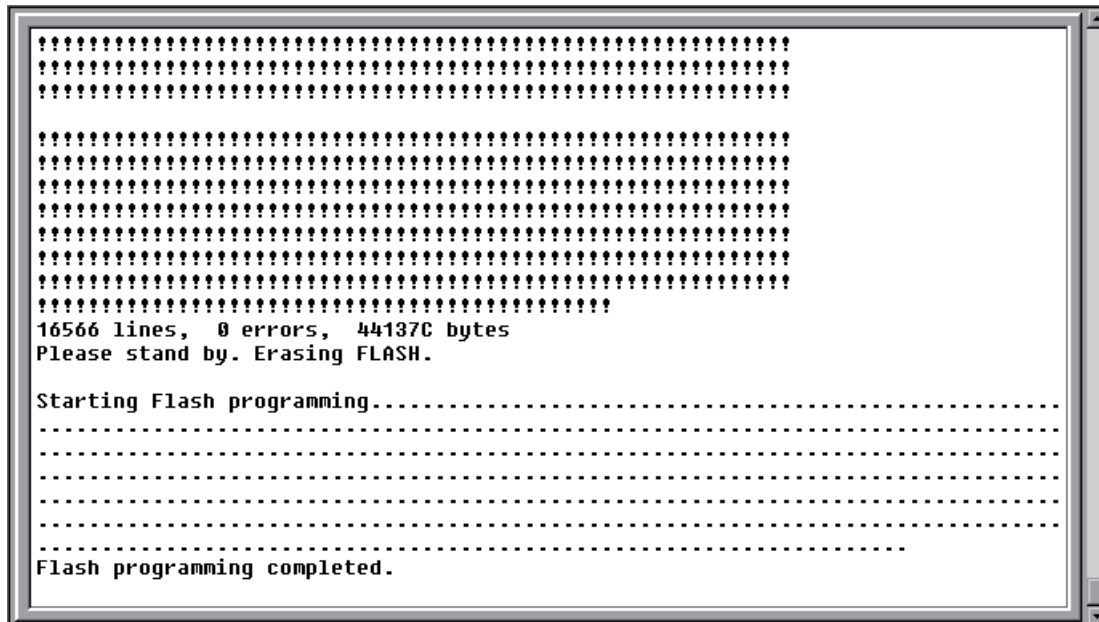
The file downloaded from the ftp site, or received on diskette, is the application code for the unit and is a Motorola S-record encoded version of the unit's object code. The download takes approximately 15 minutes at 9600 bps.

10. Select the file downloaded from FORE Systems ftp site and initiate the file transfer using a local terminal communications program, i.e., Windows Terminal or Win95 HyperTerminal.



If using Windows 3.x Terminal, select Transfers, Send Text File. Ensure that the Strip LF dialog box is not checked (disabled). If using Windows95 HyperTerminal, select Transfer, Send Text File.

11. While the transfer is in progress, an exclamation point '!' is displayed for each valid S-record received. A period '.' is displayed for invalid records. If errors are reported, re-initiate the download as described above. If the unit continues to fail, select "Rewrite running code to nonvolatile storage", in order to preserve the working code currently in the system.
12. When the transfer is complete Figure 4.26 is displayed.



**Figure 4.26 - Successful Download Display**

13. When a successful transfer is complete, press any key.
14. The SYSTEM->OPERATIONS menu is displayed as shown in Figure 4.25.
15. Press the <Space-bar> and cycle to Restart system, then press the <Enter> key.
16. The system responds with:  

```
<<<<<<< Please type the word restart followed by <CR>.
```
17. Type `restart` and press the <Enter> key to cause the downloaded code to be run.
18. The system responds with a login prompt.
19. Log onto the system to verify the software download (the new revision level is displayed at the top of the user interface screen).

## 4.13 *CellPath* 90 Bootloader Options

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The following procedure should be used to access the *CellPath* 90 bootloader functions.

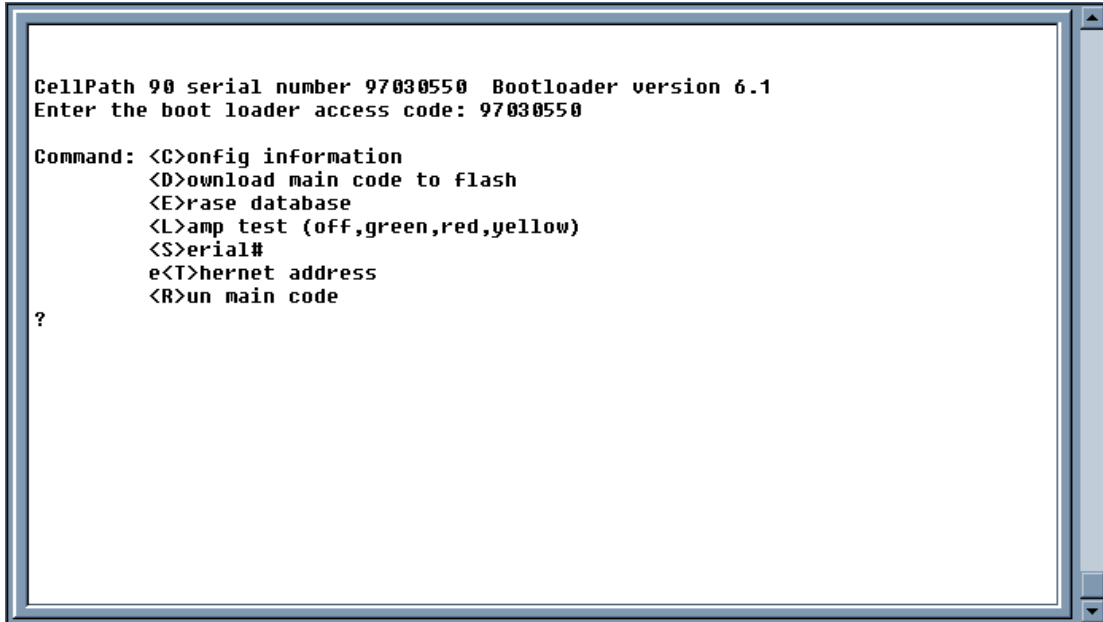


All keyboard entries used in this procedure require capital alphanumeric entries. Ensure that either the CapsLock key is depressed or hold the shift key when entering alphanumeric characters.

1. Set front panel DIP switch SW6 up and SW7 down - 9600 baud.
2. Set front panel DIP switch SW8 to the up position - bootloader.
3. Cycle power to the *CellPath* 90. The system responds with:

```
CellPath 90 serial number AENC3020-XXXX Bootloader version 6.1
Enter the boot loader access code:
```

4. Enter the bootloader access code (*CellPath* 90 serial number).
5. The system responds with the bootloader menu as shown in Figure 4.27.



**Figure 4.27 - CellPath 90 Bootloader Menu**

The options available from the *CellPath 90* bootloader menu are:

- **<C>onfig** - Displays the *CellPath 90* board configuration listing the CP90 board type, revision, and whether Fast DRAM is installed or not.
- **<D>ownload main code to flash** - Downloads operating system software into the *CellPath 90* flash memory.
- **<E>rase database** - Erases the contents of the *CellPath 90* system database.
- **<L>amp test** - Tests all front panel LEDs by cycling them through the various illumination states.

## CAUTION



The following two options, **<S>erial#** and **e<T>hernnet**, are for factory use ONLY! Any attempt to change the settings maintained by these options could corrupt the *CellPath 90* database and render the unit unusable.

- **<S>erial#** - For factory use only.

- e<T>hernet - For factory use only.
- <R>un main code - Loads and executes the currently loaded *CellPath 90* operating system.

### 4.13.1 Downloading From the Bootloader Menu

The bootload procedure is required in the event that the *CellPath 90* does not respond when attempting to access the User Interface in the normal manner.



The bootloader code reads the front panel DIP switches when loading. The communications parameters present in the DIP switches is what should be used with the terminal emulation software when performing the following steps.

1. Enter **D** (Download).
2. Enter **Y** (Yes) in response to the system message  
"Are you sure you want to do that?"
3. The system responds with  
Starting Download..."  
Begin transmission of Motorola S-records.



The software download takes approximately 15 minutes at 9600 baud.

4. Select the file downloaded from FORE Systems ftp site and initiate the file transfer using a local terminal communications program, i.e., Windows Terminal or Win95 HyperTerminal.



If using Windows 3.x Terminal, select Transfers, Send Text File. Ensure that the Strip LF dialog box is not checked (disabled). If using Windows95 HyperTerminal, select Transfer, Send Text File.

5. While the transfer is in progress, an exclamation point '!' is displayed for each valid S-record received. A period (.) is displayed for invalid records. If errors are reported, re-initiate the download as described above.
6. When the transfer is complete the bootload menu is displayed.
7. Enter **R** (Run) to load and execute the new software. The system responds with the *CellPath 90* User Interface login prompt.
8. Set front panel DIP switch SW8 to the down position - normal operation.

## 4.13.2 Downloading via TFTP

Software can be downloaded to the *CellPath 90* using Trivial File Transfer Protocol (TFTP) procedures from a tftp host. The following procedure describes the steps necessary to download the operating system to the *CellPath 90* from a remote TFTP host. Prior to performing these procedures, ensure that the binary version (.bin file extension) of the *CellPath 90* operating system has been copied to the `/tftpboot` directory on the tftp host.



An Ethernet connection must be established prior to performing this procedure via Telnet, or an SNMP ATM PVC (see *ATM Configuration*) must be established prior to performing this procedure via ATM. Additionally, the appropriate IP addresses must be setup in the SYSTEM->INTERFACES menu (see Figure 4.23).

1. Telnet to a TFTP host server.
2. Upon receipt of a telnet prompt enter `tftp`, then press the <Enter> key. The system responds with "`tftp>`".
3. Enter the following commands to establish a connection with the *CellPath 90*, setup the proper transfer mode (binary), and to transfer the binary file to the *CellPath 90* in the allocated file register.

**connect xxx.xxx.xxx.xxx<Enter>**

where `xxx.xxx.xxx.xxx` represents the Ethernet or ATM IP address assigned to the *CellPath 90*

**binary<Enter>**

**put filename.bin CellPath90<Enter>**

where `filename.bin` is the filename of the binary version of operating system code available from FORE Systems ftp site (refer to Table 4.1)

CellPath90 is name of the file register in the *CellPath 90* memory where the binary code is to be downloaded. This name is case sensitive and must be entered as shown.

4. The system responds with "Sent xxxxxx bytes in x.x seconds"  
where xxxxxx represents the byte count of the transferred file  
x.x the time to transfer the .bin file
5. Exit the tftp session by entering `quit`, then press the <Enter> key.



Following a TFTP download of the *CellPath 90* image, the user must wait approximately thirty (30) seconds before executing the following steps. This time period is necessary to allow the unit to uncompress the binary image and reprogram the internal flash memory.

6. Establish a Telnet session with the *CellPath 90* by entering  
`telnet xxx.xxx.xxx.xxx<Enter>`  
where xxx.xxx.xxx.xxx represents the Ethernet or ATM IP address assigned to the *CellPath 90*
7. Login to the *CellPath 90*, at the Supervisor level.
8. Go to SYSTEM->OPERATIONS, select "Restart system", and press the <Enter> key.
9. Respond to the *CellPath 90* prompts to restart the unit.



Restarting the *CellPath 90* causes a disconnect of the current Telnet session. To verify a successful operating system download and restart, wait approximately thirty-seconds and then re-establish a telnet session as described in steps 7 and 8 above.

### 4.13.3 Saving Configuration Database via TFTP

Software can be downloaded to the *CellPath 90* using Trivial File Transfer Protocol (TFTP) procedures from a tftp host. The following procedure describes the steps necessary to download the operating system to the *CellPath 90* from a remote TFTP host. Prior to performing these procedures, ensure that the binary version (.bin file extension) of the *CellPath 90* operating system has been copied to the local /tftpboot directory on the tftp host.


**NOTE**

An Ethernet connection must be established prior to performing this procedure via Telnet. Additionally, the appropriate IP addresses must be setup in the SYSTEM->INTERFACES menu (see Figure 4.23).

1. Telnet to a TFTP host server.
2. Upon receipt of a telnet prompt enter `tftp`, then press the <Enter> key. The system responds with "`tftp>`".
3. Enter the following commands to establish a connection with the *CellPath 90*, setup the proper transfer mode (binary), and to transfer the binary file to the *CellPath 90* in the allocated file register.

**connect xxx.xxx.xxx.xxx<Enter>**

where xxx.xxx.xxx.xxx represents the Ethernet or ATM IP address assigned to the *CellPath 90*

**binary<Enter>**

**get CellPath90\_DB filename.db<Enter>**

where CellPath90\_DB is the filename of the configuration database as stored in the *CellPath 90*. This name is case sensitive and must be entered as shown.

filename.db is a user defined filename of the retrieved configuration database. This file is not editable by the user. Any attempt at editing this file may cause the file to become corrupted.

4. The system responds with "Received xxxxxx bytes in x.x seconds"  
where xxxxxx represents the byte count of the transferred file  
x.x the time to transfer the .bin file
5. Exit the tftp session by entering `quit`, then press the <Enter> key.

### 4.13.4 Restoring Configuration Database via TFTP

Software can be downloaded to the *CellPath 90* using Trivial File Transfer Protocol (TFTP) procedures from a tftp host. The following procedure describes the steps necessary to download the operating system to the *CellPath 90* from a remote TFTP host. Prior to performing these procedures, ensure that the binary version (.bin file extension) of the *CellPath 90* operating system has been copied to the /tftpboot directory on the tftp host.

**NOTE**

An Ethernet connection must be established prior to performing this procedure via Telnet. Additionally, the appropriate IP addresses must be setup in the SYSTEM->INTERFACES menu (see Figure 4.23).

1. Telnet to a TFTP host server.
2. Upon receipt of a telnet prompt enter `tftp`, then press the <Enter> key. The system responds with "`tftp>`".
3. Enter the following commands to establish a connection with the *CellPath 90*, setup the proper transfer mode (binary), and to transfer the binary file to the *CellPath 90* in the allocated file register.

**connect xxx.xxx.xxx.xxx<Enter>**

where     xxx.xxx.xxx.xxx represents the Ethernet or ATM IP address assigned to the *CellPath 90*

**binary<Enter>**

**put filename.db CellPath90\_DB<Enter>**

where     where *filename.db* is the filename of the previously archived *CellPath 90* configuration database.

*CellPath90\_DB* is the filename of the configuration database as stored in the *CellPath 90*. This filename is case sensitive and must be entered as shown.

4. The system responds with "Received xxxxxx bytes in x.x seconds"  
where     xxxxxx represents the byte count of the transferred file  
           x.x the time to transfer the .bin file
5. Exit the tftp session by entering `quit`, then press the <Enter> key.

# APPENDIX A

## Specifications

This appendix provides information about the CellPath 90 ATM T1 WAN Multiplexer. Information provided includes hardware specifications including interface, power, and environmental specifications.

**Table A.1 - Mechanical**

Description	Specification
Dimensions	16.625" (42.5cm) W x 11" (28cm) D x 1.75" (4.5cm) H
Weight	5 Lb. (2.3 Kg.)
Installation	Stand-alone, Stackable or Rack Mount
DTE 1/2 Connector DTE 3	DB25 female (V.35/RS449/X.21/RS232C) DB15 female (Ethernet)
DTE 4 Network Connector	DB15 female for T1
NMS Port Connector	DB9 female
Ext. Clock Connector	DB9 female
Power Connector	IEC AC receptacle
Alarm Connector	DB9 female

**Table A.2 - Environmental**

Description	Specification
Temperature	32° to 122° F (0 to 50° C)
Humidity	0 to 95% non-condensing
Altitude	0 to 10,000 feet (3048 meters)
Storage Temp	-4° to 140° F (-20° C to 60° C)
Storage Altitude	15,000 feet (4572 meters) Above Sea Level

**Table A.3 - Regulatory**

Description	Specification
Equipment Safety	UL 1950, CSA 22.2, #950
Network Safety	FCC Part 68, Industry Canada, IC-03
RFI/EMI	FCC Part 15, Class A, VCCI, Class 1

**Table A.4 - Front Panel Indicators (LED's)**

Description	Specification
DTE 1 through 4	Status, TX and RX
Network	Status, TX and RX
System	Status

**Table A.5 - Power Supply**

Description	Specification
AC Power	90V- 244V AC @ 48 to 60 Hz
Fuse	1 Amp @ 250V
Power Consumption	25 Watts

**Table A.6 - NMS Port**

Description	Specification
Electrical	RS232C
Data Rates	1.2 to 19.2 kbps
Protocol	Terminal: VT100, ASCII SNMP: UDP/IP/SLIP

**Table A.7 - External Clock Input**

Description	Specification
Electrical	Differential /Single Ended
Clock Rate	1.544 Mbps $\pm$ 50 ppm

**Table A.8 - V.35/RS449/X.21 - DTE 1 and 2 Interfaces**

Description	Specification
Number of ports	Two DTE Ports, expandable to four
Interface Type	V.35/RS449/X.21
Mode	DCE
Data Rates	Nx56 and Nx64 kbps (N $\leq$ 24)
Interface	EIA530A DCE
Clock	Smooth/Gapped
Clock Modes	SCTE, SCT and inverted SCT clock
Data Type	CBR Support (Video) VBR Support (Data)
Protocol	ATM DXI and Frame Relay

**Table A.9 - Ethernet - DTE 3 Interface**

Description	Specification
Interface Type	AUI
Protocol	IEEE 802.3
Use Adapter	ThinNet, 10 Base-T

**Table A.10 - T1 - DTE 4 Interface**

Description	Specification
Interface	DSX-1
Receive Attenuation	< 10dB
Equalizer Setting	0 - 655 ft
Subrate T1	Nx64 kbps where $N \leq 20$
Cable Length	ABAM / 655 ft

**Table A.11 - Network Management**

Description	Specification
Perform. Monitoring	FEBE, FERF
Testing	Packet Generation, Loopbacks
Others	VT100, SNMP

**Table A.12 - T1 Network Interface**

Description	Specification
Electrical	T1 CSU (ANSI T1.403)
Receive Attenuation	0 to 36 dB
LBO Setting	0 dB, -7.5 dB, -15 dB, & -22.5 dB
Cable Length	3000/6000 ft
Jitter/Wander	Per AT&T PUB 62411
ESF Data Link	AT&T PUB 54016, ANSI T1.403-1989
Transmit Sync.	Loop, Internal, External

**Table A.13 - ATM Capability**

Description	Specification
Standards	ATM Forum UNI 3.1(PVC) & DXI 1.0 ITU-T I.362 & I.363
VPI/VCI	Up to 256
Adaptation	AAL1 and AAL5
Traffic Shaping	Dual Leaky Bucket
Cell Mapping	HEC/G.804
Scrambling	Optional ( $X^{43}+1$ ) (Normally set to on)

## *Specifications*

# APPENDIX B

## Additional Configuration Information

### B.1 Clock Source Selection

The *CellPath 90* provides a choice of clock source selection. A user can configure the unit for the recovered clock from T1 (Loop Timed), Internal clock or External clock (refer to Figure B.1). An External clock input is provided for operation of the *CellPath 90* using an office clock source, such as BITS.

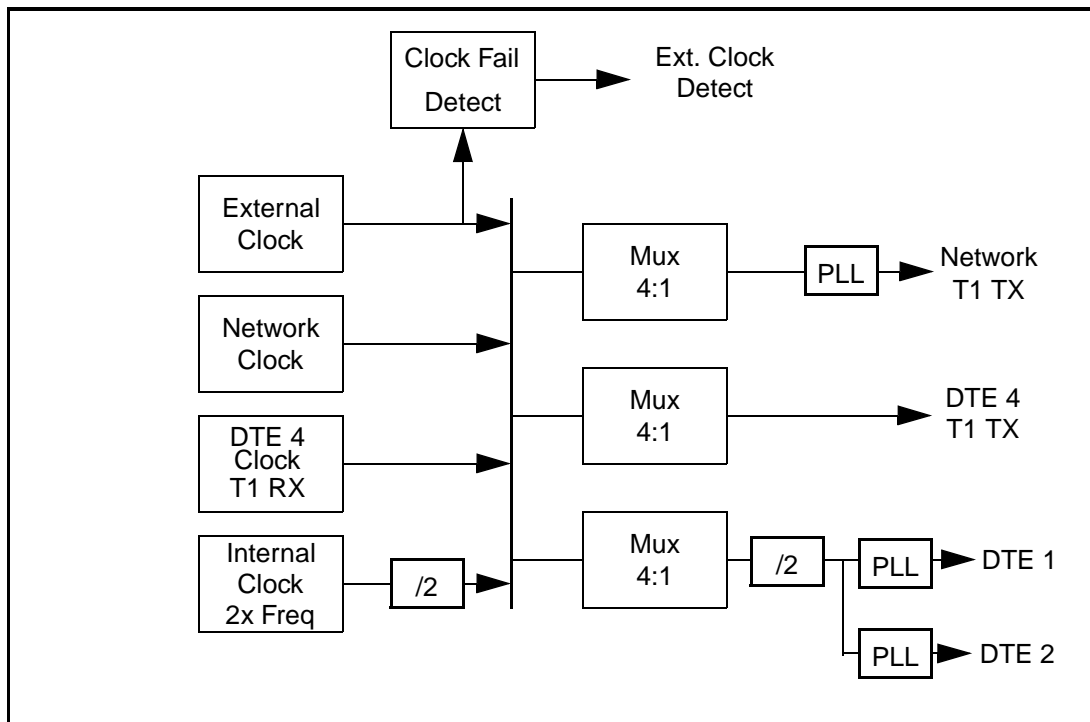


Figure B.1 - Clock Source Selection

## B.1.1 Operation

The *CellPath 90* can be configured for any of the clocking schemes via the configuration menu. The receive network logic always uses the recovered clock from network. The typical clock selection is Loop Time where the *CellPath 90* clock is phase lock-looped with the recovered clock from the network. If an accurate office clock is available the *CellPath 90* can use the External clock, however, this clock must be traceable to the network clock in order to avoid any slips. The Internal clock is useful for point-to-point applications where the network does not provide a clock. In this case the local unit is set to the Internal clock and the remote unit to Loop Timed clock.

## B.1.2 Clock Failure and Recovery

If the External or Network Clock fails *CellPath 90* automatically selects the Internal Clock. The unit switches to the selected clock three minutes following the recovery of the failed clock, if the automatic recovery option is selected.

## B.2 DTE Initiated Loopbacks

To facilitate installation and maintenance, the *CellPath 90* provides local, remote network, and terminal equipment (DTE) loopbacks (see Figure B.2). A group of three interchange circuits are defined to permit fault isolation testing to be done under control of the DTE:

- Circuit LL (Local Loopback)
- Circuit RL (Remote Loopback)
- Circuit TM (Test Mode)

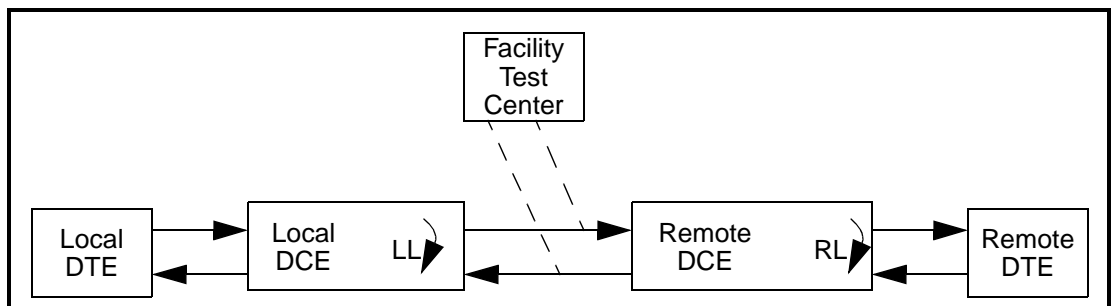


Figure B.2 - Loopback Block Diagram

## B.2.1 Local Loopback

Local loopback provides a method of checking the functionality of the DTE/DCE interface. In this test the data received by the *CellPath 90* from DTE is transmitted back to the DTE.

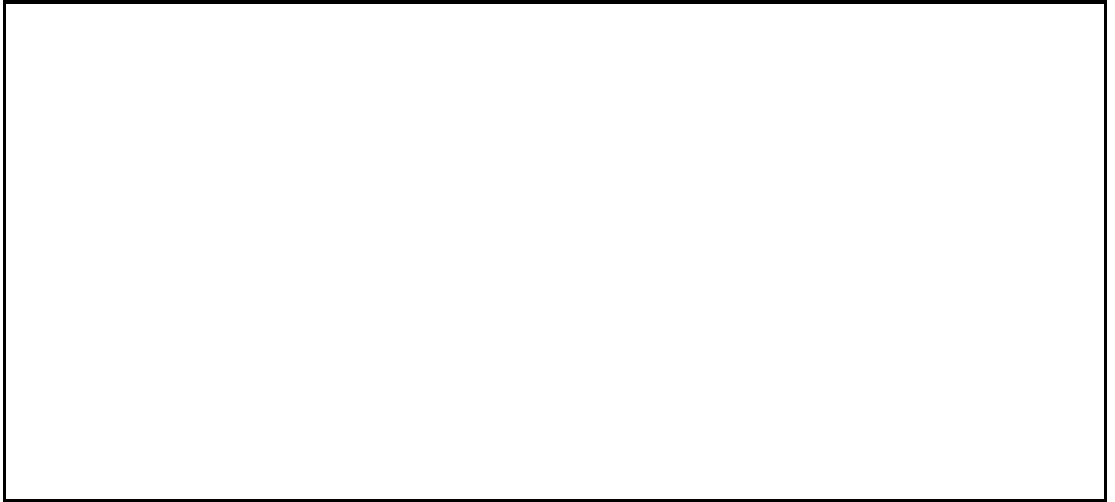
## B.2.2 Remote Loopback

Remote loopback provides a method whereby a DTE, or facility test center, may check the transmission path up to and through the remote DCE to the DTE interface. In this test, Circuit BA (Transmitted Data) and Circuit BB (Received Data) are disconnected or isolated from the remote DTE at the interface and connected to each other in the remote DCE. The *CellPath 90E* provides the required clock signals and buffers. Local and remote loopback tests cannot be performed simultaneously.

## B.3 Voice Support

---

The *CellPath 90* supports voice applications (see Figure B.3) via its DTE T1 interface. The DTE T1 interface provides clock and framing to the PBX or Channel bank connected. The voice channels received on the interface are saved in a cell buffer. The cell buffer is 47 bytes (octets) long. Once the cell buffer fills up the ATM processor attaches a 1-octet AAL1 overhead and a 5-octet ATM overhead to 47-byte data packet before sending all 53 bytes to the T1 framer circuit for transmission to the ATM network.



**Figure B.3 - Voice Support Block Diagram**

In the receive direction the ATM cells are screened for AAL1 type traffic. Once AAL1 type cells are detected, the AAL1 processor checks the AAL overhead octet for Sequence Number (SN) and Sequence Number Protection (CRC and Parity). If the AAL1 processor does not find a problem, it verifies the valid VPI/VCI and sends the 47 octet SAR-PDU payload to the Cell buffer. The information from the cell buffer is then framed and sent to the T1 line interface.

The *CellPath 90* uses the structured mode for the T1 DTE port. Structured data transfer uses an additional control byte in some cells (those with an even SN and the CSI bit set to 1) to support a Structure Pointer (SP). The SP locates the start of a block of bytes marked off by the sender. The SP field need not be present in every odd-number cells, so the CSI is set to 1 when the SP is present, alerting the receiver that the first byte in the payload is control information and not data.

## **B.4 VPI.VCI Guidelines/Restrictions**

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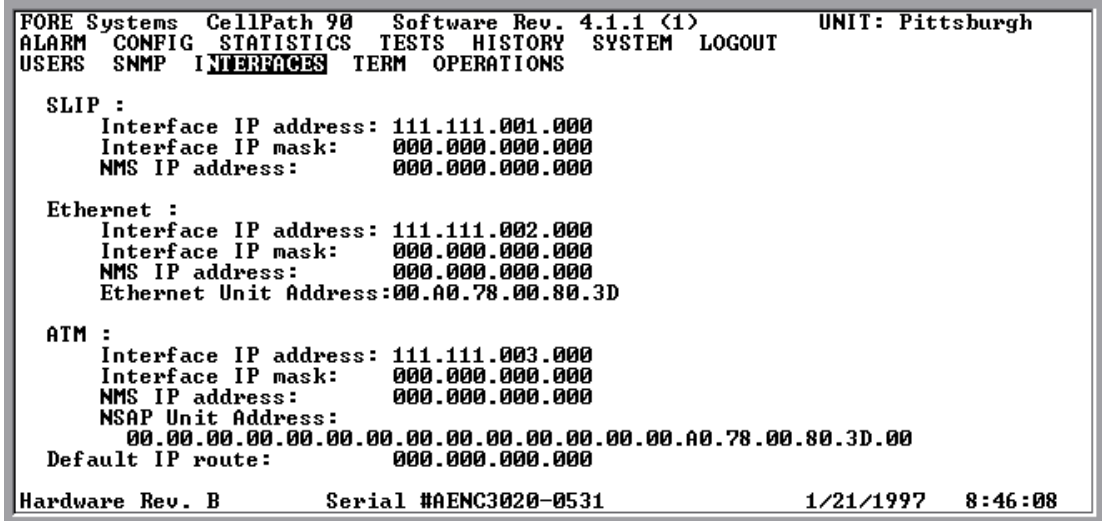
A VPI of 0, combined with VCIs in the range of 0 through 31, are typically reserved for special purpose connections (signalling, management, unassigned cells, etc.). For this reason, it is recommended that those VPI/VCIs are not used for ordinary user connections in the DTE4 and ATM configuration menus.

In cases in which the connection being routed through the *CellPath 90* uses one of the reserved VPI.VCI values, it may be necessary to use non-restricted VPI.VCI values to pass the connection through the network.

Typically, VCI 0 is used for configuring virtual channel connections (VCCs). The use of VPI 0 for channel connections is a commonly used guideline to help keep track of the configuration, and should not be considered a restriction.

## B.5 Configuring Subnet Addresses

When configuring the Internet Protocol (IP) address through the SYSTEM->INTERFACE screen, the user should assign different subnet addresses to each interface. Figure B.4 shows the correct method.



```

FORE Systems  CellPath 90  Software Rev. 4.1.1 (1)  UNIT: Pittsburgh
ALARM  CONFIG  STATISTICS  TESTS  HISTORY  SYSTEM  LOGOUT
USERS  SNMP  IINTERFACES  TERM  OPERATIONS

SLIP :
  Interface IP address: 111.111.001.000
  Interface IP mask:   000.000.000.000
  NMS IP address:     000.000.000.000

Ethernet :
  Interface IP address: 111.111.002.000
  Interface IP mask:   000.000.000.000
  NMS IP address:     000.000.000.000
  Ethernet Unit Address:00.A0.78.00.80.3D

ATM :
  Interface IP address: 111.111.003.000
  Interface IP mask:   000.000.000.000
  NMS IP address:     000.000.000.000
  NSAP Unit Address:
    00.00.00.00.00.00.00.00.00.00.00.00.00.A0.78.00.80.3D.00
  Default IP route:   000.000.000.000

Hardware Rev. B      Serial #AENC3020-0531      1/21/1997  8:46:08
  
```

Figure B.4 - Interface Screen Subnet Assignment

## *Additional Configuration Information*

# APPENDIX C

## Converting DFAs or DLCIs and VPI/VCIs

Because of the similarities between ATM DXI, Frame Relay, and ATM UNI interfaces, there is a direct correlation between the connection identifiers used in each. ATM DXI uses a connection identifier called a DXI Frame Address (DFA). Frame Relay uses a connection identifier called a Data Link Connection Identifier (DLCI). ATM UNI uses a connection identifier called a VPI/VCI.

On the *CellPath* 90, all connection identifiers must be expressed as VPI/VCIs. This chapter provides the information required to convert between VPI/VCIs and DFAs or DLCIs.

The topics discussed in the chapter are as follows:

- The different kinds of Frame Relay and ATM DXI headers and how they affect the conversion process
- Conversion procedures and formulas
- Reserved values

## C.1 Frame Relay and ATM DXI Header Types

There are four different types of headers: 2-byte Frame Relay, 2-byte ATM DXI, 4-byte Frame Relay, and 4-byte ATM DXI. The header format in use must be known in order to select the correct formula for determining the VPI/VCI. Table C.1 summarizes the four different types of headers.

**Table C.1 - Frame Relay/ATM DXI Header Types**

Header type	Description
Frame Relay or ATM DXI 2-byte header	<p>2-byte header, essentially the same for ATM DXI and Frame Relay.</p> <p>A 2-byte header has 10 bits reserved for the connection identifier allowing for <math>2^{10}</math> (1024) possible connections.</p> <p>This type of header has a fixed mapping into ATM VPI/VCIs (see Table C.4).</p>
ATM DXI 4-byte header	<p>A 4-byte header originating from an ATM DXI service has 24 bits reserved for the connection identifier.</p> <p>This type of header has a fixed mapping into ATM VPI/VCIs. There are 8 bits reserved for the VPI and 9 bits reserved for the VCI. This means there are <math>2^8</math> possible VPIs and <math>2^9</math> possible VCIs for <math>2^8 \times 2^9</math> (131072) total possible connections.</p>
Frame Relay 4-byte header	<p>A 4-byte header originating from a Frame Relay UNI service has 23 bits reserved for the connection identifier.</p> <p>This type of header uses the same mappings as required by the 4-byte header that originated from ATM DXI. There are 8 bits reserved for the VPI and 8 bits reserved for the VCI. There are <math>2^8</math> (256) possible VPIs and <math>2^8</math> possible VCIs for a total of <math>2^8 \times 2^8</math> (65536) possible connections.</p> <p>Due to the way this header type is mapped to VPI/VCIs, only even-numbered VCIs are allowed.</p>

### C.1.1 4-Byte Header Diagrams

Table C.2 and Table C.3 are included for the advanced ATM user. They explain how the VPI/VCI values are encoded in the 4-byte headers for Frame Relay and ATM DXI. The VPI and VCI fields are not contiguous, and so the conversion formulas are not straightforward.

### C.1.1.1 ATM DXI Header

**Table C.2 - ATM DXI 4-Byte Headers**

Byte	Bit							
	7	6	5	4	3	2	1	0
0	VPI 7 DFA 23	VPI 6 DFA 22	VPI 5 DFA 21	VPI 4 DFA 20	VPI 3 DFA 19	VPI 2 DFA 18	RSVD: 0	EA: 0
1	VCI 15 DFA 17	VCI 14 DFA 16	VPI 1 DFA 15	VPI 0 DFA 14	CH: X	RSVD: 0	CLP: X	EA: 0
2	VCI 13 DFA 13	VCI 12 DFA 12	VCI 11 DFA 11	VCI 10 DFA 10	VCI 9 DFA 9	VCI 8 DFA 8	VCI 7 DFA 7	EA: 0
3	VCI 6 DFA 6	VCI 5 DFA 5	VCI 4 DFA 4	VCI 3 DFA 3	VCI 2 DFA 2	VCI 1 DFA 1	VCI 0 DFA 0	EA: 1

### C.1.1.2 Frame Relay Header

**Table C.3 - Frame Relay 4-Byte Headers**

Byte	Bit							
	7	6	5	4	3	2	1	0
0	VPI 7 DLCI 22	VPI 6 DLCI 21	VPI 5 DLCI 20	VPI 4 DLCI 19	VPI 3 DLCI 18	VPI 2 DLCI 17	C/R: X	EA: 0
1	VCI 15 DLCI 16	VCI 14 DLCI 15	VPI 1 DLCI 14	VPI 0 DLCI 13	FECN: X	BECN: 0	DE: X	EA: 0
2	VCI 13 DLCI 12	VCI 12 DLCI 11	VCI 11 DLCI 10	VCI 10 DLCI 9	VCI 9 DLCI 8	VCI 8 DLCI 7	VCI 7 DLCI 6	EA: 0
3	VCI 6 DLCI 5	VCI 5 DLCI 4	VCI 4 DLCI 3	VCI 3 DLCI 2	VCI 2 DLCI 1	VCI 1 DLCI 0	VCI 0 D/C: 0	EA: 1



Some VPI/VCIs are reserved for communications between network devices. If the conversion process yields one of these VPI/VCIs, reconfigure the device to use a DLCI or DFA that does not translate into a restricted VPI/VCI.

## D.14 Conversion Table

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### D.14.1 Frame Relay/ ATM DXI 2-Byte Header to VPI/VCI

The italicized entries in Table C.4 are reserved values and should not be used for user data when connecting into a public network.

**Table C.4 - Frame Relay/ATM DXI 2-Byte Header VPI/VCI Conversion Table**

DFA/ DLCI	VPI	VCI	DFA/ DLCI	VPI	VCI	DFA/ DLCI	VPI	VCI	DFA/ DLCI	VPI	VCI
0	0	0	27	1	11	54	3	6	81	5	1
1	0	1	28	1	12	55	3	7	82	5	2
2	0	2	29	1	13	56	3	8	83	5	3
3	0	3	30	1	14	57	3	9	84	5	4
4	0	4	31	1	15	58	3	10	85	5	5
5	0	5	32	2	0	59	3	11	86	5	6
6	0	6	33	2	1	60	3	12	87	5	7
7	0	7	34	2	2	61	3	13	88	5	8
8	0	8	35	2	3	62	3	14	89	5	9
9	0	9	36	2	4	63	3	15	90	5	10
10	0	10	37	2	5	64	4	0	91	5	11
11	0	11	38	2	6	65	4	1	92	5	12
12	0	12	39	2	7	66	4	2	93	5	13
13	0	13	40	2	8	67	4	3	94	5	14
14	0	14	41	2	9	68	4	4	95	5	15
15	0	15	42	2	10	69	4	5	96	6	0
16	1	0	43	2	11	70	4	6	97	6	1
17	1	1	44	2	12	71	4	7	98	6	2
18	1	2	45	2	13	72	4	8	99	6	3
19	1	3	46	2	14	73	4	9	100	6	4
20	1	4	47	2	15	74	4	10	101	6	5
21	1	5	48	3	0	75	4	11	102	6	6
22	1	6	49	3	1	76	4	12	103	6	7
23	1	7	50	3	2	77	4	13	104	6	8
24	1	8	51	3	3	78	4	14	105	6	9
25	1	9	52	3	4	79	4	15	106	6	10
26	1	10	53	3	5	80	5	0	107	6	11

Converting DFAs or  
DLCIs and VPI/VCI

**Table C.4 - Frame Relay/ATM DXI 2-Byte Header VPI/VCI Conversion Table**

DFA/ DLCI	VPI	VCI	DFA/ DLCI	VPI	VCI	DFA/ DLCI	VPI	VCI	DFA/ DLCI	VPI	VCI
108	6	12	137	8	9	166	10	6	195	12	3
109	6	13	138	8	10	167	10	7	196	12	4
110	6	14	139	8	11	168	10	8	197	12	5
111	6	15	140	8	12	169	10	9	198	12	6
112	7	0	141	8	13	170	10	10	199	12	7
113	7	1	142	8	14	171	10	11	200	12	8
114	7	2	143	8	15	172	10	12	201	12	9
115	7	3	144	9	0	173	10	13	202	12	10
116	7	4	145	9	1	174	10	14	203	12	11
117	7	5	146	9	2	175	10	15	204	12	12
118	7	6	147	9	3	176	11	0	205	12	13
119	7	7	148	9	4	177	11	1	206	12	14
120	7	8	149	9	5	178	11	2	207	12	15
121	7	9	150	9	6	179	11	3	208	13	0
122	7	10	151	9	7	180	11	4	209	13	1
123	7	11	152	9	8	181	11	5	210	13	2
124	7	12	153	9	9	182	11	6	211	13	3
125	7	13	154	9	10	183	11	7	212	13	4
126	7	14	155	9	11	184	11	8	213	13	5
127	7	15	156	9	12	185	11	9	214	13	6
128	8	0	157	9	13	186	11	10	215	13	7
129	8	1	158	9	14	187	11	11	216	13	8
130	8	2	159	9	15	188	11	12	217	13	9
131	8	3	160	10	0	189	11	13	218	13	10
132	8	4	161	10	1	190	11	14	219	13	11
133	8	5	162	10	2	191	11	15	220	13	12
134	8	6	163	10	3	192	12	0	221	13	13
135	8	7	164	10	4	193	12	1	222	13	14
136	8	8	165	10	5	194	12	2	223	13	15

**Table C.4 - Frame Relay/ATM DXI 2-Byte Header VPI/VCI Conversion Table**

DFA/ DLCI	VPI	VCI	DFA/ DLCI	VPI	VCI	DFA/ DLCI	VPI	VCI	DFA/ DLCI	VPI	VCI
224	14	0	253	15	13	282	1	26	311	3	23
225	14	1	254	15	14	283	1	27	312	3	24
226	14	2	255	15	15	284	1	28	313	3	25
227	14	3	256	0	16	285	1	29	314	3	26
228	14	4	257	0	17	286	1	30	315	3	27
229	14	5	258	0	18	287	1	31	316	3	28
230	14	6	259	0	19	288	2	16	317	3	29
231	14	7	260	0	20	289	2	17	318	3	30
232	14	8	261	0	21	290	2	18	319	3	31
233	14	9	262	0	22	291	2	19	320	4	16
234	14	10	263	0	23	292	2	20	321	4	17
235	14	11	264	0	24	293	2	21	322	4	18
236	14	12	265	0	25	294	2	22	323	4	19
237	14	13	266	0	26	295	2	23	324	4	20
238	14	14	267	0	27	296	2	24	325	4	21
239	14	15	268	0	28	297	2	25	326	4	22
240	15	0	269	0	29	298	2	26	327	4	23
241	15	1	270	0	30	299	2	27	328	4	24
242	15	2	271	0	31	300	2	28	329	4	25
243	15	3	272	1	16	301	2	29	330	4	26
244	15	4	273	1	17	302	2	30	331	4	27
245	15	5	274	1	18	303	2	31	332	4	28
246	15	6	275	1	19	304	3	16	333	4	29
247	15	7	276	1	20	305	3	17	334	4	30
248	15	8	277	1	21	306	3	18	335	4	31
249	15	9	278	1	22	307	3	19	336	5	16
250	15	10	279	1	23	308	3	20	337	5	17
251	15	11	280	1	24	309	3	21	338	5	18
252	15	12	281	1	25	310	3	22	339	5	19

Converting DFAs or  
DLCIs and VPI/VCI

**Table C.4 - Frame Relay/ATM DXI 2-Byte Header VPI/VCI Conversion Table**

DFA/ DLCI	VPI	VCI	DFA/ DLCI	VPI	VCI	DFA/ DLCI	VPI	VCI	DFA/ DLCI	VPI	VCI
340	5	20	369	7	17	398	8	30	427	10	27
341	5	21	370	7	18	399	8	31	428	10	28
342	5	22	371	7	19	400	9	16	429	10	29
343	5	23	372	7	20	401	9	17	430	10	30
344	5	24	373	7	21	402	9	18	431	10	31
345	5	25	374	7	22	403	9	19	432	11	16
346	5	26	375	7	23	404	9	20	433	11	17
347	5	27	376	7	24	405	9	21	434	11	18
348	5	28	377	7	25	406	9	22	435	11	19
349	5	29	378	7	26	407	9	23	436	11	20
350	5	30	379	7	27	408	9	24	437	11	21
351	5	31	380	7	28	409	9	25	438	11	22
352	6	16	381	7	29	410	9	26	439	11	23
353	6	17	382	7	30	411	9	27	440	11	24
354	6	18	383	7	31	412	9	28	441	11	25
355	6	19	384	8	16	413	9	29	442	11	26
356	6	20	385	8	17	414	9	30	443	11	27
357	6	21	386	8	18	415	9	31	444	11	28
358	6	22	387	8	19	416	10	16	445	11	29
359	6	23	388	8	20	417	10	17	446	11	30
360	6	24	389	8	21	418	10	18	447	11	31
361	6	25	390	8	22	419	10	19	448	12	16
362	6	26	391	8	23	420	10	20	449	12	17
363	6	27	392	8	24	421	10	21	450	12	18
364	6	28	393	8	25	422	10	22	451	12	19
365	6	29	394	8	26	423	10	23	452	12	20
366	6	30	395	8	27	424	10	24	453	12	21
367	6	31	396	8	28	425	10	25	454	12	22
368	7	16	397	8	29	426	10	26	455	12	23

**Table C.4 - Frame Relay/ATM DXI 2-Byte Header VPI/VCI Conversion Table**

DFA/ DLCI	VPI	VCI	DFA/ DLCI	VPI	VCI	DFA/ DLCI	VPI	VCI	DFA/ DLCI	VPI	VCI
456	12	24	485	14	21	514	0	34	543	1	47
457	12	25	486	14	22	515	0	35	544	2	32
458	12	26	487	14	23	516	0	36	545	2	33
459	12	27	488	14	24	517	0	37	546	2	34
460	12	28	489	14	25	518	0	38	547	2	35
461	12	29	490	14	26	519	0	39	548	2	36
462	12	30	491	14	27	520	0	40	549	2	37
463	12	31	492	14	28	521	0	41	550	2	38
464	13	16	493	14	29	522	0	42	551	2	39
465	13	17	494	14	30	523	0	43	552	2	40
466	13	18	495	14	31	524	0	44	553	2	41
467	13	19	496	15	16	525	0	45	554	2	42
468	13	20	497	15	17	526	0	46	555	2	43
469	13	21	498	15	18	527	0	47	556	2	44
470	13	22	499	15	19	528	1	32	557	2	45
471	13	23	500	15	20	529	1	33	558	2	46
472	13	24	501	15	21	530	1	34	559	2	47
473	13	25	502	15	22	531	1	35	560	3	32
474	13	26	503	15	23	532	1	36	561	3	33
475	13	27	504	15	24	533	1	37	562	3	34
476	13	28	505	15	25	534	1	38	563	3	35
477	13	29	506	15	26	535	1	39	564	3	36
478	13	30	507	15	27	536	1	40	565	3	37
479	13	31	508	15	28	537	1	41	566	3	38
480	14	16	509	15	29	538	1	42	567	3	39
481	14	17	510	15	30	539	1	43	568	3	40
482	14	18	511	15	31	540	1	44	569	3	41
483	14	19	512	0	32	541	1	45	570	3	42
484	14	20	513	0	33	542	1	46	571	3	43

Converting DFAs or  
DLCIs and VPI/VCI

**Table C.4 - Frame Relay/ATM DXI 2-Byte Header VPI/VCI Conversion Table**

DFA/ DLCI	VPI	VCI	DFA/ DLCI	VPI	VCI	DFA/ DLCI	VPI	VCI	DFA/ DLCI	VPI	VCI
572	3	44	601	5	41	630	7	38	659	9	35
573	3	45	602	5	42	631	7	39	660	9	36
574	3	46	603	5	43	632	7	40	661	9	37
575	3	47	604	5	44	633	7	41	662	9	38
576	4	32	605	5	45	634	7	42	663	9	39
577	4	33	606	5	46	635	7	43	664	9	40
578	4	34	607	5	47	636	7	44	665	9	41
579	4	35	608	6	32	637	7	45	666	9	42
580	4	36	609	6	33	638	7	46	667	9	43
581	4	37	610	6	34	639	7	47	668	9	44
582	4	38	611	6	35	640	8	32	669	9	45
583	4	39	612	6	36	641	8	33	670	9	46
584	4	40	613	6	37	642	8	34	671	9	47
585	4	41	614	6	38	643	8	35	672	10	32
586	4	42	615	6	39	644	8	36	673	10	33
587	4	43	616	6	40	645	8	37	674	10	34
588	4	44	617	6	41	646	8	38	675	10	35
589	4	45	618	6	42	647	8	39	676	10	36
590	4	46	619	6	43	648	8	40	677	10	37
591	4	47	620	6	44	649	8	41	678	10	38
592	5	32	621	6	45	650	8	42	679	10	39
593	5	33	622	6	46	651	8	43	680	10	40
594	5	34	623	6	47	652	8	44	681	10	41
595	5	35	624	7	32	653	8	45	682	10	42
596	5	36	625	7	33	654	8	46	683	10	43
597	5	37	626	7	34	655	8	47	684	10	44
598	5	38	627	7	35	656	9	32	685	10	45
599	5	39	628	7	36	657	9	33	686	10	46
600	5	40	629	7	37	658	9	34	687	10	47

**Table C.4 - Frame Relay/ATM DXI 2-Byte Header VPI/VCI Conversion Table**

DFA/ DLCI	VPI	VCI	DFA/ DLCI	VPI	VCI	DFA/ DLCI	VPI	VCI	DFA/ DLCI	VPI	VCI
688	11	32	717	12	45	746	14	42	775	0	55
689	11	33	718	12	46	747	14	43	776	0	56
690	11	34	719	12	47	748	14	44	777	0	57
691	11	35	720	13	32	749	14	45	778	0	58
692	11	36	721	13	33	750	14	46	779	0	59
693	11	37	722	13	34	751	14	47	780	0	60
694	11	38	723	13	35	752	15	32	781	0	61
695	11	39	724	13	36	753	15	33	782	0	62
696	11	40	725	13	37	754	15	34	783	0	63
697	11	41	726	13	38	755	15	35	784	1	48
698	11	42	727	13	39	756	15	36	785	1	49
699	11	43	728	13	40	757	15	37	786	1	50
700	11	44	729	13	41	758	15	38	787	1	51
701	11	45	730	13	42	759	15	39	788	1	52
702	11	46	731	13	43	760	15	40	789	1	53
703	11	47	732	13	44	761	15	41	790	1	54
704	12	32	733	13	45	762	15	42	791	1	55
705	12	33	734	13	46	763	15	43	792	1	56
706	12	34	735	13	47	764	15	44	793	1	57
707	12	35	736	14	32	765	15	45	794	1	58
708	12	36	737	14	33	766	15	46	795	1	59
709	12	37	738	14	34	767	15	47	796	1	60
710	12	38	739	14	35	768	0	48	797	1	61
711	12	39	740	14	36	769	0	49	798	1	62
712	12	40	741	14	37	770	0	50	799	1	63
713	12	41	742	14	38	771	0	51	800	2	48
714	12	42	743	14	39	772	0	52	801	2	49
715	12	43	744	14	40	773	0	53	802	2	50
716	12	44	745	14	41	774	0	54	803	2	51

Converting DFAs or  
DLCIs and VPI/VCI

**Table C.4 - Frame Relay/ATM DXI 2-Byte Header VPI/VCI Conversion Table**

DFA/ DLCI	VPI	VCI	DFA/ DLCI	VPI	VCI	DFA/ DLCI	VPI	VCI	DFA/ DLCI	VPI	VCI
804	2	52	833	4	49	862	5	62	891	7	59
805	2	53	834	4	50	863	5	63	892	7	60
806	2	54	835	4	51	864	6	48	893	7	61
807	2	55	836	4	52	865	6	49	894	7	62
808	2	56	837	4	53	866	6	50	895	7	63
809	2	57	838	4	54	867	6	51	896	8	48
810	2	58	839	4	55	868	6	52	897	8	49
811	2	59	840	4	56	869	6	53	898	8	50
812	2	60	841	4	57	870	6	54	899	8	51
813	2	61	842	4	58	871	6	55	900	8	52
814	2	62	843	4	59	872	6	56	901	8	53
815	2	63	844	4	60	873	6	57	902	8	54
816	3	48	845	4	61	874	6	58	903	8	55
817	3	49	846	4	62	875	6	59	904	8	56
818	3	50	847	4	63	876	6	60	905	8	57
819	3	51	848	5	48	877	6	61	906	8	58
820	3	52	849	5	49	878	6	62	907	8	59
821	3	53	850	5	50	879	6	63	908	8	60
822	3	54	851	5	51	880	7	48	909	8	61
823	3	55	852	5	52	881	7	49	910	8	62
824	3	56	853	5	53	882	7	50	911	8	63
825	3	57	854	5	54	883	7	51	912	9	48
826	3	58	855	5	55	884	7	52	913	9	49
827	3	59	856	5	56	885	7	53	914	9	50
828	3	60	857	5	57	886	7	54	915	9	51
829	3	61	858	5	58	887	7	55	916	9	52
830	3	62	859	5	59	888	7	56	917	9	53
831	3	63	860	5	60	889	7	57	918	9	54
832	4	48	861	5	61	890	7	58	919	9	55

**Table C.4 - Frame Relay/ATM DXI 2-Byte Header VPI/VCI Conversion Table**

DFA/ DLCI	VPI	VCI	DFA/ DLCI	VPI	VCI	DFA/ DLCI	VPI	VCI	DFA/ DLCI	VPI	VCI
920	9	56	949	11	53	978	13	50	1007	14	63
921	9	57	950	11	54	979	13	51	1008	15	48
922	9	58	951	11	55	980	13	52	1009	15	49
923	9	59	952	11	56	981	13	53	1010	15	50
924	9	60	953	11	57	982	13	54	1011	15	51
925	9	61	954	11	58	983	13	55	1012	15	52
926	9	62	955	11	59	984	13	56	1013	15	53
927	9	63	956	11	60	985	13	57	1014	15	54
928	10	48	957	11	61	986	13	58	1015	15	55
929	10	49	958	11	62	987	13	59	1016	15	56
930	10	50	959	11	63	988	13	60	1017	15	57
931	10	51	960	12	48	989	13	61	1018	15	58
932	10	52	961	12	49	990	13	62	1019	15	59
933	10	53	962	12	50	991	13	63	1020	15	60
934	10	54	963	12	51	992	14	48	1021	15	61
935	10	55	964	12	52	993	14	49	1022	15	62
936	10	56	965	12	53	994	14	50	1023	15	63
937	10	57	966	12	54	995	14	51			
938	10	58	967	12	55	996	14	52			
939	10	59	968	12	56	997	14	53			
940	10	60	969	12	57	998	14	54			
941	10	61	970	12	58	999	14	55			
942	10	62	971	12	59	1000	14	56			
943	10	63	972	12	60	1001	14	57			
944	11	48	973	12	61	1002	14	58			
945	11	49	974	12	62	1003	14	59			
946	11	50	975	12	63	1004	14	60			
947	11	51	976	13	48	1005	14	61			
948	11	52	977	13	49	1006	14	62			

Converting DFAs or  
DLCIs and VPI/VCI



# APPENDIX D

## Connector Pinouts

**Table D.1 - NMS Connector (DB9) Pin Assignments**

Pin	Circuit	Description	Signal Direction
1	CD	Carrier Detect	To <i>CellPath 90</i>
2	SD	Send Data	From <i>CellPath 90</i>
3	RD	Receive Data	To <i>CellPath 90</i>
5	SG	Signal Ground	
8	CTS	Clear to send	Common to <i>CellPath 90</i>
Pins 4, 6, 7, and 9 are not connected			

**Table D.2 - T1 Network Connector (DB15) Pin Assignments**

DB15 Pin	Circuit	RJ45 Pin	Signal Direction
1	Tip (T1)	4	Output to Network
2	F/Gnd	7	Frame Ground
3	Tip (T)	1	Input from Network
4	F/Gnd	8	Frame Ground
9	Ring (R1)	5	Output to Network
11	Ring (R)	2	Input from Network

**Table D.3 - EIA-530A to V.35 Pin Assignments**

Pin	EIA-530A Mnemonic	Pin	V.35 Mnemonic	Signal Direction	Signal Description
1	Shield	A	Shield	Common	Shield
2	BA (A)	P	103 (A)	To DCE	Transmit Data
3	BB (A)	R	104 (A)	From DCE	Received Data
4	CA (A)	C	105	To DCE	Request to Send
5	CB (A)	D	106	From DCE	Clear To Send
6	CC	E	107	From DCE	DCE Ready
7	AB	B	102	Common	Signal Common
8	CF (A)	F	109	From DCE	Received Line
9	DD (B)	X	115 (B)	From DCE	Timing (DCE Source)
10	CF (B)			From DCE	Signal Detector
11	DA (B)	W	113 (B)	To DCE	Timing (DTE Source)
12	DB (B)	AA	114 (B)	From DCE	Timing (DCE Source)
13	CB (B)			From DCE	Clear To Send
14	BA (B)	S	103 (B)	To DCE	Transmit Data
15	DB (A)	Y	114 (A)	From DCE	Transmit Signal Element
16	BB (B)	T	104 (B)	From DCE	Received Data
17	DD (A)	V	115 (A)	From DCE	Receiver Signal element
18	LL	L	141	To DCE	Local Loopback
19	CA (B)			To DCE	Request to Send
20	CD	H	108/1,/2	To DCE	DTE Ready
21	RL	N	140	To DCE	Remote Loopback
22	CE	J	125	From DCE	Ring Indicator
23	AC	B	102	Common	Signal Common
24	DA (A)	U	113 (A)	To DCE	Transmit Signal element
25	TM	NN	142	From DCE	Test Mode

**Table D.4 - EIA-530A to RS449 Pin Assignments**

Pin #	EIA-530A Mnemonic	Pin #	RS449 Mnemonic	Signal Direction	Signal Description
1	Shield	1	Shield	Common	Shield
2	BA (A)	4	SD (A)	To DCE	Transmit Data
3	BB (A)	6	RD (A)	From DCE	Receive Data
4	CA (A)	7	RS (A)	To DCE	Request To Send
5	CB (A)	9	CS (A)	From DCE	Clear To Send
6	CC	11	DM (A)	From DCE	DCE Ready
7	AB	19 <sup>a</sup>	SG	Common	Signal Ground
		30 <sup>a</sup>	TR (B)	To DCE	
		37 <sup>a</sup>	SC		
8	CF (A)	13	RR (A)	From DCE	Receive Line
9	DD (B)	26	RT (B)	From DCE	Timing (DCE Source)
10	CF (B)	31	RR (B)	From DCE	Signal Detector
11	DA (B)	35	TT (B)	To DCE	Timing (DTE Source)
12	DB (B)	23	ST (B)	From DCE	Timing (DCE Source)
13	CB (B)	27	CS (B)	From DCE	Clear To Send
14	BA (B)	22	SD (B)	To DCE	Transmit Data
15	DB (A)	5	ST (A)	From DCE	Transmit Signal Element
16	BB (B)	24	RD (B)	From DCE	Receive Data
17	DD (A)	8	RT (A)	From DCE	Receive Signal Element
18	LL	10	LL	To DCE	Local Loopback
19	CA (B)	25	RS (B)	To DCE	Request To Send
20	CD	12	TR (A)	To DCE	DTE Ready
21	RL	14	RL	To DCE	Remote Loopback
22	CE	15	IC	From DCE	Ring Indicator
23	AC	20 <sup>b</sup>	RC	Common	Signal Common

**Table D.4 - EIA-530A to RS449 Pin Assignments**

Pin #	EIA-530A Mnemonic	Pin #	RS449 Mnemonic	Signal Direction	Signal Description
		29 <sup>b</sup>	DM (B)	From DCE	
24	DA(A)	17	TT (A)	To DCE	Transmit Signal Element
25	TM	18	TM	From DCE	Test Mode

- a. For proper operation with an EIA-449 DCE, connect 19, 30 and 37.
- b. For proper operation with an EIA-449 DTE, connect 20 and 29.

**Table D.5 - EIA-530A to X.21 Pin Assignments**

Pin	EIA-530A Mnemonic	Signal Direction	Signal Description
1	Shield	Common	Shield
2	BA (A)	To DTE	Transmit Data
3	BB (A)	From DTE	Received Data
4	CA (A)	To DTE	Request to Send
5	CB (A)	From DTE	Clear To Send
6	CC	From DTE	DE Ready
7	AB	Common	Signal Common
8	CF (A)	From DCE	Received Line
9	DD (B)	From DCE	Timing (DCE Source)
10	CF (B)	From DCE	Signal Detector
11	DA (B)	To DCE	Timing (DTE Source)
12	DB (B)	From DCE	Timing (DCE Source)
13	CB (B)	From DTE	Clear To Send
14	BA (B)	To DTE	Transmit Data
15	DB (A)	From DCE	Transmit Signal Element
16	BB (B)	From DTE	Received Data
17	DD (A)	From DCE	Receiver Signal element
18	LL	To DCE	Local Loopback
19	CA (B)	To DTE	Request to Send
20	CD	To DTE	DE Ready
21	RL	To DCE	Remote Loopback
22	CE	From DCE	Ring Indicator
23	AC	Common	Signal Common
24	DA (A)	To DCE	Transmit Signal element
25	TM	From DCE	Test Mode

**Table D.6 - DTE to DCE Cable**

<b>Pin (P1)</b>	<b>CellPath 90</b>	<b>Pin (P2)</b>	<b>EIA530 Mnemonic</b>
1	Shield	1	Shield
2	SD (A)	3	RD (A)
14	SD (B)	16	RD (B)
3	RD (A)	2	SD (A)
16	RD (B)	14	SD (B)
4	RS (A)	5	CS (A)
19	RS (B)	13	RS (B)
5	CS (A)	4	RS (A)
13	CS (B)	19	RS (B)
6	DM (A)	20	TR (A)
20	TR (A)	6	DM (A)
7	SG	7	SG
15	SCT (A)	15	SCT (A)
12	SCT (B)	12	SCT (B)
24	SCTE (A)	17	SCR (A)
11	SCTE (B)	9	SCR (B)
17	SCR (A)	24	SCTE (A)
9	SCR (B)	11	SCTE (B)

**Table D.7 - Ethernet Connector (DB-15) Pin assignment**

Pin	Circuit	Description
1	CI-S	Control In Shield
2	CI-A	Control In A
3	DO-A	Data Out A
4	DI-S	Data In Shield
5	DI-A	Data In A
6	VC	Voltage Common
7	CO-A	Control Out A (not connected)
8	CO-S	Control Out Shield (not connected)
9	CI-B	Control In B
10	DO-B	Data Out B
11	DO-S	Data Out Shield
12	DI-B	Data In B
13	VP	Voltage Plus
14	VS	Voltage Shield (L25 and M25)
15	CO-B	Control Out B (not connected)

**Table D.8 - External Clock Connector (DB-9) Pin Assignment**

Pin	Circuit	Description
1	CLK-In+	Input Clock
2	CLK-IN+	Input Clock
5	GND	Ground
Pins 3, 4, 6, 7, 8 and 9 are not connected. If adapting to BNC, connect pins 2 and 5 together at the DB9 end.		



# APPENDIX E

## Configuration Worksheets

This appendix provides “blank” configuration worksheets that can be filled out prior to, or during, configuration of the *CellPath 90* ATM T1 WAN Multiplexer. These worksheets can make the configuration task easier since all the information needed for the task is gathered before starting to program the unit. Refer to *Chapter 4, Configuration* for detailed descriptions of the options presented on each worksheet. Figure E.1 presents a map of the *CellPath 90* menus, with those areas that require configuration highlighted. For each unit, fill out:

- “System Configuration Worksheet”
- “Port Worksheet” for each interface port configured

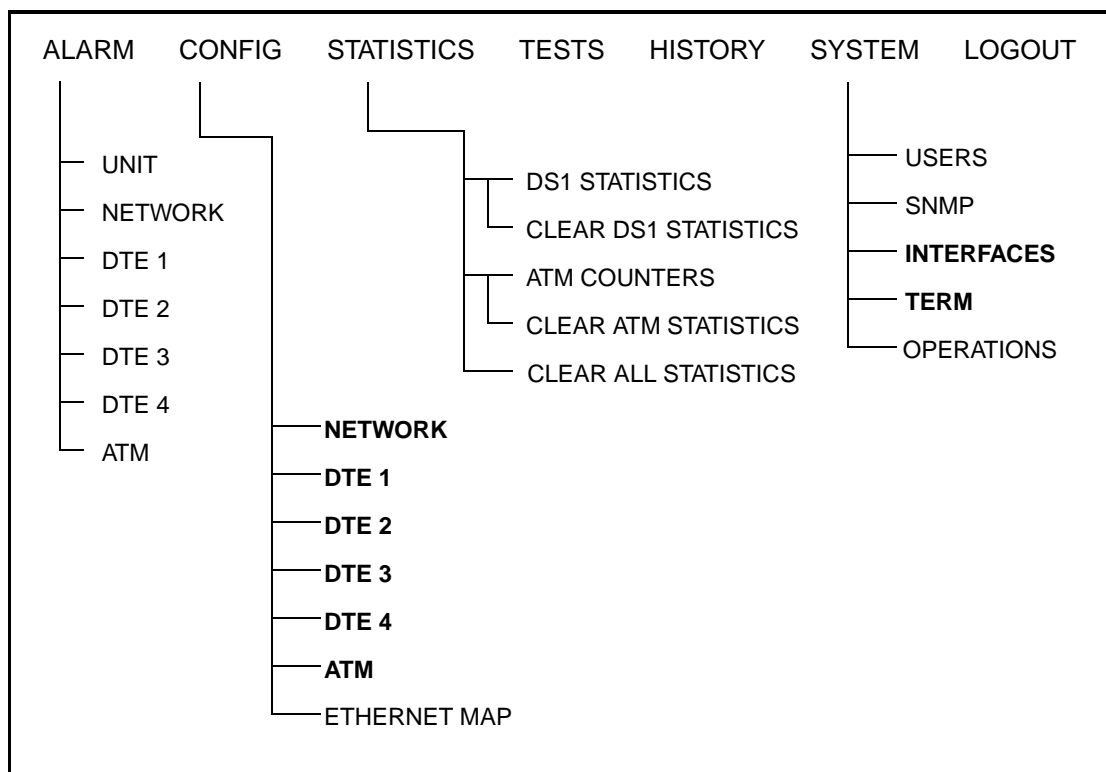


Figure E.1 - *CellPath 90* Menu Map



## CellPath 90 System Configuration Worksheet

**Unit Name:** (up to 16 characters) \_\_\_\_\_

**Serial #:** AENC3020- \_\_\_\_\_

*If using Telnet, assign the CellPath 90 the same  
Telnet system name assigned it in the host file.*

**Software Rev.:** \_\_\_\_\_

**Hardware Rev.:** \_\_\_\_\_

### Interfaces:

*When configuring IP addresses,  
unique subnet addresses are  
required for each interface  
group.*

#### SLIP:

IP address: \_\_\_\_\_

IP mask: \_\_\_\_\_

NMS IP address: \_\_\_\_\_

#### Ethernet:

IP address: \_\_\_\_\_

IP mask: \_\_\_\_\_

NMS IP address: \_\_\_\_\_

#### ATM:

IP address: \_\_\_\_\_

IP mask: \_\_\_\_\_

NMS IP address: \_\_\_\_\_

Default IP route: \_\_\_\_\_

### Terminal Settings:

**Baud Rate:** \_\_\_\_\_ bps

**Data Bits:** ☐ 7 ☐ 8

**Stop Bits:** ☐ 1 ☐ 2

**Parity:** ☐ None ☐ Even ☐ Odd

**Flow Control:** ☐ Off ☐ On

**Term Port Appl:** ☐ Menu ☐ SNMP

**Update Rate** ☐ Off ☐ Slow ☐ Fast

**Multidrop:** ☐ Off ☐ On

**Term. Logout:** ☐ Off ☐ 5 ☐ 15 ☐ 30



CellPath 90 T1 Network Configuration Worksheet	
Framing:	<input checked="" type="checkbox"/> ESF
Line Code:	<input checked="" type="checkbox"/> B8ZS
LBO:	<input type="checkbox"/> 0.0 dB <input type="checkbox"/> -7.5 dB <input type="checkbox"/> -15 dB <input type="checkbox"/> -22 dB
Timing:	<input type="checkbox"/> Recovered <input type="checkbox"/> External <input type="checkbox"/> Recovered DTE4 <input type="checkbox"/> Internal
Cell payload scrambler:	<input type="checkbox"/> On <input type="checkbox"/> Off
Network alarms:	<input type="checkbox"/> On <input type="checkbox"/> Off
Unit alarms:	<input type="checkbox"/> On <input type="checkbox"/> Off
Assembly timeout (in milliseconds):_____    Allowable range 100 through 10000	
Use CSU loop codes:	<input type="checkbox"/> On <input type="checkbox"/> Off
<div></div>	



<b>CellPath 90 DTE 1 Configuration Worksheet</b>		
<b>Interface:</b>	<input type="checkbox"/> V.35	<input type="checkbox"/> RS-449
<b>Clocking:</b>	<input type="checkbox"/> SCT	<input type="checkbox"/> SCT Inverted
	<input type="checkbox"/> SCTE	<input type="checkbox"/> FROM DCE <i>(Requires DTE-to-DCE cable)</i>
<b>Mode:</b>	<input type="checkbox"/> Continuous	<input type="checkbox"/> Gapped <i>(Not available if FROM DCE set)</i>
<b>Rate:</b>	_____ Kb/s	
<b>Protocol:</b>	<input type="checkbox"/> ATM DXI 1a (Frame relay, 2-byte header, CRC-16) <input type="checkbox"/> Structured AAL1 V.35 CBR (no signalling) <input type="checkbox"/> Transparent (AAL1 CBR) <input type="checkbox"/> Raw HDLC, CRC-16 (CEX Mode) <input type="checkbox"/> Raw HDLC, CRC-32 (CEX Mode)	
<b>DTE-present Signal Control:</b>	<input type="checkbox"/> None <input type="checkbox"/> RTS <input type="checkbox"/> DTR	
<b>DTE 1 alarms:</b>	<input type="checkbox"/> On <input type="checkbox"/> Off	
<b>Maximum burst size (in bytes):</b>	_____ <i>Allowable range 1500 to 65535. Recommended setting 9232.</i>	
<b>Control lead settings:</b>  <div style="display: flex; flex-direction: column; gap: 5px;"> <div>DSR:    <input type="checkbox"/> Normal    <input type="checkbox"/> Off    <input type="checkbox"/> On</div> <div>RLSD:    <input type="checkbox"/> Normal    <input type="checkbox"/> Off    <input type="checkbox"/> On</div> <div>CTS:    <input type="checkbox"/> Normal    <input type="checkbox"/> Off    <input type="checkbox"/> On</div> <div>TM:    <input type="checkbox"/> Normal    <input type="checkbox"/> Off    <input type="checkbox"/> On</div> </div>		



<b>CellPath 90 DTE 2 Configuration Worksheet</b>		
<b>Interface:</b>	<input type="checkbox"/> V.35	<input type="checkbox"/> RS-449
<b>Clocking:</b>	<input type="checkbox"/> SCT	<input type="checkbox"/> SCT Inverted
	<input type="checkbox"/> SCTE	<input type="checkbox"/> FROM DCE <i>(Requires DTE-to-DCE cable)</i>
<b>Mode:</b>	<input type="checkbox"/> Continuous	<input type="checkbox"/> Gapped <i>(Not available if FROM DCE set)</i>
<b>Rate:</b>	_____ Kb/s	
<b>Protocol:</b>	<input type="checkbox"/> ATM DXI 1a (Frame relay, 2-byte header, CRC-16) <input type="checkbox"/> Structured AAL1 V.35 CBR (no signalling) <input type="checkbox"/> Transparent (AAL1 CBR) <input type="checkbox"/> Raw HDLC, CRC-16 (CEX Mode) <input type="checkbox"/> Raw HDLC, CRC-32 (CEX Mode)	
<b>DTE-present Signal Control:</b>	<input type="checkbox"/> None <input type="checkbox"/> RTS <input type="checkbox"/> DTR	
<b>DTE 1 alarms:</b>	<input type="checkbox"/> On <input type="checkbox"/> Off	
<b>Maximum burst size (in bytes):</b>	_____ <i>Allowable range 1500 to 65535. Recommended setting 9232.</i>	
<b>Control lead settings:</b>  <div style="display: flex; flex-direction: column; gap: 5px;"> <div> <b>DSR:</b>    <input type="checkbox"/> Normal    <input type="checkbox"/> Off    <input type="checkbox"/> On         </div> <div> <b>RLSD:</b>    <input type="checkbox"/> Normal    <input type="checkbox"/> Off    <input type="checkbox"/> On         </div> <div> <b>CTS:</b>    <input type="checkbox"/> Normal    <input type="checkbox"/> Off    <input type="checkbox"/> On         </div> <div> <b>TM:</b>    <input type="checkbox"/> Normal    <input type="checkbox"/> Off    <input type="checkbox"/> On         </div> </div>		



CellPath 90 DTE 3 Configuration Worksheet	
Interface:	<input checked="" type="checkbox"/> Ethernet
DTE 3 alarms:	<input type="checkbox"/> On <input type="checkbox"/> Off
Maximum burst size (in bytes):	_____ Allowable range 1500 to 65535. Recommended setting 9232.
Ethernet filtering polarity:	<input type="checkbox"/> Positive <input type="checkbox"/> Negative
Ethernet protocol:	<input type="checkbox"/> RFC-1483 w/CRC <input type="checkbox"/> RFC-1483 w/o CRC



CellPath 90 DTE 4 Configuration Worksheet																																																																	
Interface:	<input checked="" type="checkbox"/> T1 DTE																																																																
Channel usage:	<div><div>1</div><div>8</div><div>16</div><div>24</div><div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div></div></div>																																																																
Framing:	<input type="checkbox"/> ESF <input type="checkbox"/> D4																																																																
Line code:	<input type="checkbox"/> B8Zs <input type="checkbox"/> AMI																																																																
EQL:	<input type="checkbox"/> 0-133' <input type="checkbox"/> 133-266' <input type="checkbox"/> 266-399' <input type="checkbox"/> 399-533' <input type="checkbox"/> 533-655'																																																																
DTE 4 alarms:	<input type="checkbox"/> On <input type="checkbox"/> Off																																																																
Parity bit processing:	<input type="checkbox"/> Process <input type="checkbox"/> Ignore																																																																
<table><thead><tr><th rowspan="2">Bundle</th><th rowspan="2">Protocol</th><th rowspan="2">VPI.VCI</th><th colspan="2">Default Signaling</th></tr><tr><th>on-hook</th><th>off-hook</th></tr></thead><tbody><tr><td rowspan="2">#1</td><td><input type="checkbox"/> F/T1 (Fractional T1)</td><td>____.____</td><td>____</td><td>____</td></tr><tr><td><input type="checkbox"/> F/T1 w/sig (Fractional T1 w/signaling)</td><td></td><td></td><td></td></tr><tr><td rowspan="2">#2</td><td><input type="checkbox"/> F/T1 (Fractional T1)</td><td>____.____</td><td>____</td><td>____</td></tr><tr><td><input type="checkbox"/> F/T1 w/sig (Fractional T1 w/signaling)</td><td></td><td></td><td></td></tr><tr><td rowspan="2">#3</td><td><input type="checkbox"/> F/T1 (Fractional T1)</td><td>____.____</td><td>____</td><td>____</td></tr><tr><td><input type="checkbox"/> F/T1 w/sig (Fractional T1 w/signaling)</td><td></td><td></td><td></td></tr><tr><td rowspan="2">#4</td><td><input type="checkbox"/> F/T1 (Fractional T1)</td><td>____.____</td><td>____</td><td>____</td></tr><tr><td><input type="checkbox"/> F/T1 w/sig (Fractional T1 w/signaling)</td><td></td><td></td><td></td></tr><tr><td rowspan="2">#5</td><td><input type="checkbox"/> F/T1 (Fractional T1)</td><td>____.____</td><td>____</td><td>____</td></tr><tr><td><input type="checkbox"/> F/T1 w/sig (Fractional T1 w/signaling)</td><td></td><td></td><td></td></tr><tr><td rowspan="2">#6</td><td><input type="checkbox"/> F/T1 (Fractional T1)</td><td>____.____</td><td>____</td><td>____</td></tr><tr><td><input type="checkbox"/> F/T1 w/sig (Fractional T1 w/signaling)</td><td></td><td></td><td></td></tr></tbody></table>					Bundle	Protocol	VPI.VCI	Default Signaling		on-hook	off-hook	#1	<input type="checkbox"/> F/T1 (Fractional T1)	____.____	____	____	<input type="checkbox"/> F/T1 w/sig (Fractional T1 w/signaling)				#2	<input type="checkbox"/> F/T1 (Fractional T1)	____.____	____	____	<input type="checkbox"/> F/T1 w/sig (Fractional T1 w/signaling)				#3	<input type="checkbox"/> F/T1 (Fractional T1)	____.____	____	____	<input type="checkbox"/> F/T1 w/sig (Fractional T1 w/signaling)				#4	<input type="checkbox"/> F/T1 (Fractional T1)	____.____	____	____	<input type="checkbox"/> F/T1 w/sig (Fractional T1 w/signaling)				#5	<input type="checkbox"/> F/T1 (Fractional T1)	____.____	____	____	<input type="checkbox"/> F/T1 w/sig (Fractional T1 w/signaling)				#6	<input type="checkbox"/> F/T1 (Fractional T1)	____.____	____	____	<input type="checkbox"/> F/T1 w/sig (Fractional T1 w/signaling)			
Bundle	Protocol	VPI.VCI	Default Signaling																																																														
			on-hook	off-hook																																																													
#1	<input type="checkbox"/> F/T1 (Fractional T1)	____.____	____	____																																																													
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#2	<input type="checkbox"/> F/T1 (Fractional T1)	____.____	____	____																																																													
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#3	<input type="checkbox"/> F/T1 (Fractional T1)	____.____	____	____																																																													
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#4	<input type="checkbox"/> F/T1 (Fractional T1)	____.____	____	____																																																													
	<input type="checkbox"/> F/T1 w/sig (Fractional T1 w/signaling)																																																																
#5	<input type="checkbox"/> F/T1 (Fractional T1)	____.____	____	____																																																													
	<input type="checkbox"/> F/T1 w/sig (Fractional T1 w/signaling)																																																																
#6	<input type="checkbox"/> F/T1 (Fractional T1)	____.____	____	____																																																													
	<input type="checkbox"/> F/T1 w/sig (Fractional T1 w/signaling)																																																																



# CellPath 90 ATM Configuration Worksheet

#	Port	SCR (Kb/s)	PCR (Kb/s)	Cell drop	Shaping	AAL	VPC /VCC	VPI. VCI	DLCI
1	ILMI	128	672	<input checked="" type="checkbox"/> PCR <input type="checkbox"/> SCR <input type="checkbox"/> Off	<input checked="" type="checkbox"/> On <input type="checkbox"/> Off	<input type="checkbox"/> AAL1 <input checked="" type="checkbox"/> AAL5	<input type="checkbox"/> VPC <input checked="" type="checkbox"/> VCC	0.16	16
2				<input type="checkbox"/> PCR <input type="checkbox"/> SCR <input type="checkbox"/> Off	<input type="checkbox"/> On <input type="checkbox"/> Off	<input type="checkbox"/> AAL1 <input type="checkbox"/> AAL5	<input type="checkbox"/> VPC <input type="checkbox"/> VCC		
3				<input type="checkbox"/> PCR <input type="checkbox"/> SCR <input type="checkbox"/> Off	<input type="checkbox"/> On <input type="checkbox"/> Off	<input type="checkbox"/> AAL1 <input type="checkbox"/> AAL5	<input type="checkbox"/> VPC <input type="checkbox"/> VCC		
4				<input type="checkbox"/> PCR <input type="checkbox"/> SCR <input type="checkbox"/> Off	<input type="checkbox"/> On <input type="checkbox"/> Off	<input type="checkbox"/> AAL1 <input type="checkbox"/> AAL5	<input type="checkbox"/> VPC <input type="checkbox"/> VCC		
5				<input type="checkbox"/> PCR <input type="checkbox"/> SCR <input type="checkbox"/> Off	<input type="checkbox"/> On <input type="checkbox"/> Off	<input type="checkbox"/> AAL1 <input type="checkbox"/> AAL5	<input type="checkbox"/> VPC <input type="checkbox"/> VCC		
6				<input type="checkbox"/> PCR <input type="checkbox"/> SCR <input type="checkbox"/> Off	<input type="checkbox"/> On <input type="checkbox"/> Off	<input type="checkbox"/> AAL1 <input type="checkbox"/> AAL5	<input type="checkbox"/> VPC <input type="checkbox"/> VCC		
7				<input type="checkbox"/> PCR <input type="checkbox"/> SCR <input type="checkbox"/> Off	<input type="checkbox"/> On <input type="checkbox"/> Off	<input type="checkbox"/> AAL1 <input type="checkbox"/> AAL5	<input type="checkbox"/> VPC <input type="checkbox"/> VCC		
8				<input type="checkbox"/> PCR <input type="checkbox"/> SCR <input type="checkbox"/> Off	<input type="checkbox"/> On <input type="checkbox"/> Off	<input type="checkbox"/> AAL1 <input type="checkbox"/> AAL5	<input type="checkbox"/> VPC <input type="checkbox"/> VCC		
9				<input type="checkbox"/> PCR <input type="checkbox"/> SCR <input type="checkbox"/> Off	<input type="checkbox"/> On <input type="checkbox"/> Off	<input type="checkbox"/> AAL1 <input type="checkbox"/> AAL5	<input type="checkbox"/> VPC <input type="checkbox"/> VCC		
10				<input type="checkbox"/> PCR <input type="checkbox"/> SCR <input type="checkbox"/> Off	<input type="checkbox"/> On <input type="checkbox"/> Off	<input type="checkbox"/> AAL1 <input type="checkbox"/> AAL5	<input type="checkbox"/> VPC <input type="checkbox"/> VCC		

**Set port to:**

- = unused
- 1 = DTE1
- 2 = DTE2
- 3 = DTE3
- 4 = DTE4
- SNMP = SNMP Network Management Station
- ILMI = Interim Local Management Interface

*Avoid using VCIs in the range of 0-31 for user connections. Typically, VCI 0 is used for configuring VCCs.*

**Use additional sheets, as required.**

### CellPath 90 ATM Configuration Worksheet (cont'd)

#	Port	SCR (Kb/s)	PCR (Kb/s)	Cell drop	Shaping	AAL	VPC /VCC	VPI. VCI	DLCI
_____	_____	_____	_____	<input type="checkbox"/> PCR <input type="checkbox"/> SCR <input type="checkbox"/> Off	<input type="checkbox"/> On <input type="checkbox"/> Off	<input type="checkbox"/> AAL1 <input type="checkbox"/> AAL5	<input type="checkbox"/> VPC <input type="checkbox"/> VCC	_____	_____
_____	_____	_____	_____	<input type="checkbox"/> PCR <input type="checkbox"/> SCR <input type="checkbox"/> Off	<input type="checkbox"/> On <input type="checkbox"/> Off	<input type="checkbox"/> AAL1 <input type="checkbox"/> AAL5	<input type="checkbox"/> VPC <input type="checkbox"/> VCC	_____	_____
_____	_____	_____	_____	<input type="checkbox"/> PCR <input type="checkbox"/> SCR <input type="checkbox"/> Off	<input type="checkbox"/> On <input type="checkbox"/> Off	<input type="checkbox"/> AAL1 <input type="checkbox"/> AAL5	<input type="checkbox"/> VPC <input type="checkbox"/> VCC	_____	_____
_____	_____	_____	_____	<input type="checkbox"/> PCR <input type="checkbox"/> SCR <input type="checkbox"/> Off	<input type="checkbox"/> On <input type="checkbox"/> Off	<input type="checkbox"/> AAL1 <input type="checkbox"/> AAL5	<input type="checkbox"/> VPC <input type="checkbox"/> VCC	_____	_____
_____	_____	_____	_____	<input type="checkbox"/> PCR <input type="checkbox"/> SCR <input type="checkbox"/> Off	<input type="checkbox"/> On <input type="checkbox"/> Off	<input type="checkbox"/> AAL1 <input type="checkbox"/> AAL5	<input type="checkbox"/> VPC <input type="checkbox"/> VCC	_____	_____
_____	_____	_____	_____	<input type="checkbox"/> PCR <input type="checkbox"/> SCR <input type="checkbox"/> Off	<input type="checkbox"/> On <input type="checkbox"/> Off	<input type="checkbox"/> AAL1 <input type="checkbox"/> AAL5	<input type="checkbox"/> VPC <input type="checkbox"/> VCC	_____	_____
_____	_____	_____	_____	<input type="checkbox"/> PCR <input type="checkbox"/> SCR <input type="checkbox"/> Off	<input type="checkbox"/> On <input type="checkbox"/> Off	<input type="checkbox"/> AAL1 <input type="checkbox"/> AAL5	<input type="checkbox"/> VPC <input type="checkbox"/> VCC	_____	_____
_____	_____	_____	_____	<input type="checkbox"/> PCR <input type="checkbox"/> SCR <input type="checkbox"/> Off	<input type="checkbox"/> On <input type="checkbox"/> Off	<input type="checkbox"/> AAL1 <input type="checkbox"/> AAL5	<input type="checkbox"/> VPC <input type="checkbox"/> VCC	_____	_____
_____	_____	_____	_____	<input type="checkbox"/> PCR <input type="checkbox"/> SCR <input type="checkbox"/> Off	<input type="checkbox"/> On <input type="checkbox"/> Off	<input type="checkbox"/> AAL1 <input type="checkbox"/> AAL5	<input type="checkbox"/> VPC <input type="checkbox"/> VCC	_____	_____
_____	_____	_____	_____	<input type="checkbox"/> PCR <input type="checkbox"/> SCR <input type="checkbox"/> Off	<input type="checkbox"/> On <input type="checkbox"/> Off	<input type="checkbox"/> AAL1 <input type="checkbox"/> AAL5	<input type="checkbox"/> VPC <input type="checkbox"/> VCC	_____	_____
_____	_____	_____	_____	<input type="checkbox"/> PCR <input type="checkbox"/> SCR <input type="checkbox"/> Off	<input type="checkbox"/> On <input type="checkbox"/> Off	<input type="checkbox"/> AAL1 <input type="checkbox"/> AAL5	<input type="checkbox"/> VPC <input type="checkbox"/> VCC	_____	_____
_____	_____	_____	_____	<input type="checkbox"/> PCR <input type="checkbox"/> SCR <input type="checkbox"/> Off	<input type="checkbox"/> On <input type="checkbox"/> Off	<input type="checkbox"/> AAL1 <input type="checkbox"/> AAL5	<input type="checkbox"/> VPC <input type="checkbox"/> VCC	_____	_____

# Acronyms

The networking terms in the following list are defined in the Glossary of this manual. Glossary items are listed alphabetically according to the full term.

<b>AAL</b>	ATM Adaptation Layer
<b>ABR</b>	Available Bit Rate
<b>ACM</b>	Address Complete Message
<b>ACR</b>	Allowable Cell Rate
<b>ADPCM</b>	Adaptive Differential Pulse Code Modulation
<b>AHFG</b>	ATM-attached Host Functional Group
<b>AIMUX</b>	ATM Inverse Multiplexing
<b>AIS</b>	Alarm Indication Signal
<b>AMI</b>	Alternate Mark Inversion
<b>AMI</b>	ATM Management Interface
<b>ANSI</b>	American National Standards Institute
<b>APCM</b>	Adaptive Pulse Code Modulation
<b>API</b>	Application Program Interface
<b>APP</b>	Application Program
<b>APS</b>	Automatic Protection Switching
<b>ARP</b>	Address Resolution Protocol
<b>ASCII</b>	American Standard Code for Information Interchange
<b>ATDM</b>	Asynchronous Time Division Multiplexing
<b>ATM</b>	Asynchronous Transfer Mode
<b>AUI</b>	Attachment User Interface
<b>B8ZS</b>	Bipolar 8 Zero Substitution
<b>BCOB</b>	Broadband Connection Oriented Bearer
<b>BCOB-A</b>	Bearer Class A
<b>BCOB-C</b>	Bearer Class C
<b>BCOB-X</b>	Bearer Class X
<b>BECN</b>	Backward Explicit Congestion Notification
<b>BER</b>	Bit Error Rate
<b>BES</b>	Bursty Errored Seconds
<b>BGP</b>	Border Gateway Protocol
<b>B-ICI</b>	B-ISDN Inter-Carrier Interface.
<b>BIP</b>	Bit Interleaved Parity
<b>B-ISDN</b>	Broadband Integrated Services Digital Network
<b>B-ISUP</b>	Broadband ISDN User's Part

## Acronyms

<b>BITS</b>	Building Integrated Timing Supply
<b>BNC</b>	Bayonet-Neill-Concelman
<b>BPDU</b>	Bridge Protocol Data Unit
<b>bps</b>	Bits per Second
<b>BPV</b>	Bipolar Violation
<b>B-TE</b>	Broadband Terminal Equipment
<b>BUS</b>	Broadcast and Unknown Server
<b>CAC</b>	Connection Admission Control
<b>CAS</b>	Channel Associated Signaling
<b>CBDS</b>	Connectionless Broadband Data Service
<b>CBR</b>	Constant Bit Rate
<b>CCITT</b>	International Telephone and Telegraph Consultative Committee
<b>CCS</b>	Common Channel Signaling
<b>CDV</b>	Cell Delay Variation
<b>CE</b>	Connection Endpoint
<b>CEI</b>	Connection Endpoint Identifier
<b>CES</b>	Circuit Emulation Service
<b>CGA</b>	Carrier Group Alarm
<b>CIP</b>	Carrier Identification Parameter
<b>CIR</b>	Committed Information Rate
<b>CLIP</b>	Classical IP
<b>CLP</b>	Cell Loss Priority
<b>CLR</b>	Cell Loss Ratio-1-15
<b>CLS</b>	Connectionless service
<b>CMIP</b>	Common Management Interface Protocol
<b>CMR</b>	Cell Misinsertion Rate
<b>CPE</b>	Customer Premise Equipment
<b>CRA</b>	Cell Rate Adaptation
<b>CRC</b>	Cyclic Redundancy Check
<b>CRS</b>	Cell Relay Service
<b>CS</b>	Controlled Slip, <b>or</b> Convergence Sublayer
<b>CSU</b>	Channel Service Unit
<b>CTD</b>	Cell Transfer Delay
<b>CTS</b>	Clear To Send
<b>DACS</b>	Digital Access and Cross-Connect System
<b>DARPA</b>	Defense Advanced Research Projects Agency
<b>DCC</b>	Data Country Code
<b>DCE</b>	Data Communications Equipment
<b>DCS</b>	Digital Cross-connect System
<b>DES</b>	Destination End Station
<b>DFA</b>	DXI Frame Address
<b>DLCI</b>	Data Link Connection Identifier

<b>DNS</b>	Domain Naming System
<b>DSn</b>	Digital Standard n (n=0, 1, 1C, 2, and 3)
<b>DSR</b>	Data Set Ready
<b>DTE</b>	Data Terminal Equipment
<b>DTR</b>	Data Terminal Ready
<b>EEPROM</b>	Electrically Erasable Programmable Read Only Memory
<b>EFCI</b>	Explicit Forward Congestion Indication
<b>EGP</b>	Exterior Gateway Protocol
<b>EIA</b>	Electronics Industries Association
<b>EISA</b>	Extended Industry Standard Architecture
<b>ELAN</b>	Emulated Local Area Network
<b>EMI</b>	Electromagnetic Interference
<b>EPROM</b>	Erasable Programmable Read Only Memory
<b>EQL</b>	Equalization
<b>ER</b>	Explicit Rate
<b>ES</b>	End System, <b>or</b> Errored Second
<b>ESF</b>	Extended Super Frame
<b>ESI</b>	End System Identifier
<b>EXZ</b>	Excessive Zeroes (Error Event)
<b>FC</b>	Face Contact
<b>FCC</b>	Federal Communications Commission
<b>FCS</b>	Frame Check Sequence
<b>FDDI</b>	Fiber Distributed Data Interface
<b>FDM</b>	Frequency Division Multiplexing
<b>FEBE</b>	Far End Block Error
<b>FEC</b>	Forward Error Correction
<b>FECN</b>	Forward Explicit Congestion Notification
<b>FERF</b>	Far End Receive Failure
<b>FIFO</b>	First-In, First-Out
<b>FRS</b>	Frame-Relay Service
<b>FTP</b>	File Transfer Protocol
<b>FT-PNNI</b>	ForeThought PNNI
<b>FUNI</b>	Frame-Based UNI
<b>GCAC</b>	Generic Connection Admission Control
<b>GCRA</b>	Generic Cell Rate Algorithm
<b>GFC</b>	Generic Flow Control
<b>HDB3</b>	High Density Bipolar
<b>HDLC</b>	High Level Data Link Control
<b>HEC</b>	Header Error Control
<b>HIPPI</b>	High Performance Parallel Interface
<b>HSSI</b>	High-Speed Serial Interface
<b>ICMP</b>	Internet Control Message Protocol

## Acronyms

<b>IDU</b>	Interface Data Unit
<b>IEEE</b>	Institute of Electrical and Electronics Engineers
<b>IETF</b>	Internet Engineering Task Force
<b>ILMI</b>	Interim Local Management Interface
<b>IP</b>	Internet Protocol
<b>IPX</b>	Internetwork Packet Exchange
<b>IS</b>	Intermediate system
<b>ISDN</b>	Integrated Services Digital Network
<b>ISO</b>	International Standards Organization
<b>ITU-T</b>	International Telecommunication Union Telecommunication
<b>IWF</b>	Interworking Function
<b>IXC</b>	Interexchange Carriers
<b>JPEG</b>	Joint Photographic Experts Group
<b>Kbps</b>	Kilobits per second
<b>LAN</b>	Local Area Network
<b>LANE</b>	LAN Emulation
<b>LAPB</b>	Link Access Procedure, Balanced
<b>LATA</b>	Local Access and Transport Area
<b>LBO</b>	Line Build Out
<b>LCV</b>	Line Code Violations
<b>LE_ARP</b>	LAN Emulation Address Resolution Protocol
<b>LEC</b>	LAN Emulation Client
<b>LECS</b>	LAN Emulation Configuration Server
<b>LES</b>	LAN Emulation Server
<b>LLC</b>	Logical Link Control
<b>LOF</b>	Loss Of Frame
<b>LOP</b>	Loss Of Pointer
<b>LOS</b>	Loss Of Signal
<b>LSB</b>	Least Significant Bit
<b>MAC</b>	Media Access Control
<b>MAN</b>	Metropolitan Area Network
<b>MAU</b>	Media Attachment Unit
<b>MBS</b>	Maximum Burst Size
<b>MCDV</b>	Maximum Cell Delay Variance
<b>MCLR</b>	Maximum Cell Loss Ratio
<b>MCR</b>	Minimum Cell Rate
<b>MCTD</b>	Maximum Cell Transfer Delay
<b>MIB</b>	Management Information Base
<b>MIC</b>	Media Interface Connector
<b>MID</b>	Message Identifier
<b>MMF</b>	Multimode Fiber Optic Cable
<b>MPEG</b>	Motion Picture Experts Group
<b>MPOA</b>	Multiprotocol over ATM

<b>MSB</b>	Most Significant Bit
<b>MTU</b>	Maximum Transmission Unit
<b>NM</b>	Network Management Entity
<b>NML</b>	Network Management Layer
<b>NMS</b>	Network Management Station
<b>NNI</b>	Network-to-Network Interface or Network Node Interface
<b>NPC</b>	Network Parameter Control
<b>NRZ</b>	Non Return to Zero
<b>NRZI</b>	Non Return to Zero Inverted
<b>NSAP</b>	Network Service Access Point
<b>NTSC</b>	National TV Standards Committee
<b>OAM</b>	Operation and Maintenance Cell
<b>OC-n</b>	Optical Carrier level-n
<b>OID</b>	Object Identifier
<b>OOF</b>	Out-of-Frame
<b>OSI</b>	Open Systems Interconnection
<b>OSPF</b>	Open Shortest Path First Protocol
<b>OUI</b>	Organizationally Unique Identifier
<b>PAD</b>	Packet Assembler Disassembler
<b>PAL</b>	Phase Alternate Line
<b>PBX</b>	Private Branch Exchange
<b>PCI</b>	Peripheral Component Interconnect
<b>PCM</b>	Pulse Code Modulation
<b>PCR</b>	Peak Cell Rate
<b>PDN</b>	Public Data Network
<b>PDU</b>	Protocol Data Unit
<b>PHY</b>	Physical Layer
<b>ping</b>	Packet Internet Groper
<b>PLCP</b>	Physical Layer Convergence Protocol
<b>PLP</b>	Packet Level Protocol
<b>PM</b>	Physical Medium
<b>PMD</b>	Physical Medium Dependent
<b>PNNI</b>	Private Network Node Interface or Private Network-to-Network Interface
<b>PPP</b>	Point-to-Point Protocol
<b>PROM</b>	Programmable Read-Only Memory
<b>PRS</b>	Primary Reference Source
<b>PSN</b>	Packet Switched Network
<b>PT</b>	Payload Type
<b>PVC</b>	Permanent Virtual Circuit (or Channel)
<b>PVCC</b>	Permanent Virtual Channel Connection
<b>PVPC</b>	Permanent Virtual Path Connection
<b>QD</b>	Queuing Delay
<b>QoS</b>	Quality of Service

## Acronyms

<b>RD</b>	Routing Domain
<b>RFCs</b>	Requests For Comment
<b>RFI</b>	Radio Frequency Interference
<b>RIP</b>	Routing Information Protocol
<b>RISC</b>	Reduced Instruction Set Computer
<b>RTS</b>	Request To Send
<b>SA</b>	Source Address
<b>SA</b>	Source MAC Address
<b>SAP</b>	Service Access Point
<b>SAR</b>	Segmentation And Reassembly
<b>SC</b>	Structured Cabling, <b>or</b> Structured Connectors, <b>or</b> Stick and Click
<b>SCR</b>	Sustainable Cell Rate
<b>SCSI</b>	Small Computer Systems Interface
<b>SDLC</b>	Synchronous Data Link Control
<b>SDU</b>	Service Data Unit
<b>SEAL</b>	Simple and Efficient Adaptation Layer
<b>SECAM</b>	Systeme En Couleur Avec Memoire
<b>SEL</b>	Selector
<b>SES</b>	Severely Errored Seconds
<b>SF</b>	Super Frame
<b>SGMP</b>	Simple Gateway Management Protocol
<b>SIR</b>	Sustained Information Rate
<b>SLIP</b>	Serial Line IP
<b>SMDs</b>	Switched Multimegabit Data Service
<b>SMF</b>	Single Mode Fiber
<b>SMTP</b>	Simple Mail Transfer Protocol
<b>SNA</b>	Systems Network Architecture
<b>SNAP</b>	SubNetwork Access Protocol
<b>SNI</b>	Subscriber Network Interface
<b>SNMP</b>	Simple Network Management Protocol
<b>SONET</b>	Synchronous Optical Network
<b>SPANS</b>	Simple Protocol for ATM Network Signalling
<b>SPARC</b>	Scalable Processor Architecture Reduced instruction set Computer
<b>SPE</b>	Synchronous Payload Envelope
<b>SPVC</b>	Smart PVC
<b>SS7</b>	Signaling System No. 7
<b>SSCOP</b>	Service Specific Connection Oriented Protocol
<b>SSCS</b>	Service Specific Convergence Sublayer
<b>ST</b>	Straight Tip, <b>or</b> Stick and Turn
<b>STM</b>	Synchronous Transfer Mode

<b>STP</b>	Shielded Twisted Pair, Spanning Tree Protocol
<b>STS</b>	Synchronous Transport Signal
<b>SVC</b>	Switched Virtual Circuit (or Channel)
<b>SVCC</b>	Switched Virtual Channel Connection
<b>SVPC</b>	Switched Virtual Path Connection
<b>TAXI</b>	Transparent Asynchronous Transmitter/Receiver Interface
<b>TC</b>	Transmission Convergence
<b>TCP</b>	Transmission Control Protocol
<b>TCP/IP</b>	Transmission Control Protocol/Internet Protocol
<b>TCR</b>	Tagged Cell Rate
<b>TCS</b>	Transmission Convergence Sublayer
<b>TDM</b>	Time Division Multiplexing
<b>TE</b>	Terminal Equipment
<b>TFTP</b>	Trivial File Transfer Protocol
<b>TM</b>	Traffic Management
<b>UAS</b>	Unavailable Seconds
<b>UBR</b>	Unspecified Bit Rate
<b>UDP</b>	User Datagram Protocol
<b>UNI</b>	User-to-Network Interface
<b>UPC</b>	Usage Parameter Control
<b>UTOPIA</b>	Universal Test & Operations Interface for ATM
<b>UTP</b>	Unshielded Twisted Pair
<b>VBR</b>	Variable Bit Rate
<b>VC</b>	Virtual Channel (or Circuit)
<b>VCC</b>	Virtual Channel Connection
<b>VCI</b>	Virtual Channel Identifier
<b>VCL</b>	Virtual Channel Link
<b>VINES</b>	Virtual Network Software
<b>VLAN</b>	Virtual Local Area Network
<b>VP</b>	Virtual Path
<b>VPC</b>	Virtual Path Connection
<b>VPDN</b>	Virtual Private Data Network
<b>VPI</b>	Virtual Path Identifier
<b>VPL</b>	Virtual Path Link
<b>VPN</b>	Virtual Private Network
<b>VPT</b>	Virtual Path Terminator
<b>VS/VD</b>	Virtual Source/Virtual Destination
<b>VT</b>	Virtual Tributary
<b>WAN</b>	Wide-Area Network
<b>ZBTSI</b>	Zero Byte Time Slot Interchange



# Glossary

**10Base-T** - a 10 Mbps baseband Ethernet specification utilizing twisted-pair cabling (Category 3, 4, or 5). 10BaseT, which is part of the IEEE 802.3 specification, has a distance limit of approximately 100 meters per segment.

**802.1d Spanning Tree Bridging** - the IEEE standard for bridging; a MAC layer standard for transparently connecting two or more LANs (often called subnetworks) that are running the same protocols and cabling. This arrangement creates an extended network, in which any two workstations on the linked LANs can share data.

**802.3 Ethernet** - the IEEE standard for Ethernet; a physical-layer standard that uses the CSMA/CD access method on a bus-topology LAN.

**802.5 Token Ring** - the IEEE physical-layer standard that uses the token-passing access method on a ring-topology LAN.

**AAL Connection** - an association established by the AAL between two or more next higher layer entities.

**Adapter** - A fitting that supplies a passage between two sets of equipment when they cannot be directly interconnected.

**Adaptive Differential Pulse Code Modulation (ADPCM)** - A technique that allows analog voice signals to be carried on a 32K bps digital channel. Sampling is done at 8Hz with 4 bits used to describe the difference between adjacent samples.

**Adaptive Pulse Code Modulation (APCM)** - A technique that effectively reduces occupied bandwidth per active speaker by reducing sampling rates during periods of overflow peak traffic.

**Address** - A unique identity of each network station on a LAN or WAN.

**Address Complete Message (ACM)** - A B-ISUP call control message from the receiving exchange to sending exchange indicating the completion of address information.

**Address Mask** - a bit mask used to identify which bits in an address (usually an IP address) are network significant, subnet significant, and host significant portions of the complete address. This mask is also known as the subnet mask because the subnetwork portion of the address can be determined by comparing the binary version of the mask to an IP address in that subnet. The mask holds the same number of bits as the protocol address it references.

**Address Prefix** - A string of 0 or more bits up to a maximum of 152 bits that is the lead portion of one or more ATM addresses.

**Address Resolution** - The procedure by which a client associates a LAN destination with the ATM address of another client or the BUS.

**Address Resolution Protocol (ARP)** - a method used to resolve higher level protocol addressing (such as IP) into the appropriate header data required for ATM; i.e., port, VPI, and VCI; also defines the AAL type to be used.

**Agent** - a component of network- and desktop-management software, such as SNMP, that gathers information from MIBs.

**alarm** - an unsolicited message from a device, typically indicating a problem with the system that requires attention.

**Alarm Indication Signal (AIS)** - In T1, an all ones condition used to alert a receiver that its incoming signal (or frame) has been lost. The loss of signal or frame is detected at the receiving end, and the failed signal is replaced by all the ones condition which the receiver interprets as an AIS. The normal response to this is AIS is for the receiving end to generate a yellow alarm signal as part of its transmission towards the faulty end. (The AIS itself is sometimes called a Blue Signal).

**A-Law** - The PCM coding and companding standard used in Europe.

**Allowable Cell Rate (ACR)** - parameter defined by the ATM Forum for ATM traffic management. ACR varies between the MCR and the PCR, and is dynamically controlled using congestion control mechanisms.

**Alternate Mark Inversion (AMI)** - A line coding format used on T1 facilities that transmits ones by alternate positive and negative pulses.

**Alternate Routing** - A mechanism that supports the use of a new path after an attempt to set up a connection along a previously selected path fails.

**American National Standards Institute (ANSI)** - a private organization that coordinates the setting and approval of some U.S. standards. It also represents the United States to the International Standards Organization.

**American Standard Code for Information Interchange (ASCII)** - a standard character set that (typically) assigns a 7-bit sequence to each letter, number, and selected control characters.

**AppleTalk** - a networking protocol developed by Apple Computer for communication between Apple's products and other computers. Independent of the network layer, AppleTalk runs on LocalTalk, EtherTalk and TokenTalk.

**Application Layer** - Layer seven of the ISO reference model; provides the end-user interface.

**Application Program (APP)** - a complete, self-contained program that performs a specific function directly for the user.

**Application Program Interface (API)** - a language format that defines how a program can be made to interact with another program, service, or other software; it allows users to develop custom interfaces with FORE products.

**Assigned Cell** - a cell that provides a service to an upper layer entity or ATM Layer Management entity (ATMM-entity).

**asxmon** - a FORE program that repeatedly displays the state of the switch and its active ports.

**Asynchronous Time Division Multiplexing (ATDM)** - a multiplexing technique in which a transmission capability is organized into a priori, unassigned time slots. The time slots are assigned to cells upon request of each application's instantaneous real need.

**Asynchronous Transfer Mode (ATM)** - a transfer mode in which the information is organized into cells. It is asynchronous in the sense that the recurrence of cells containing information from an individual user is not necessarily periodic.

**ATM Adaptation Layer (AAL)** - the AAL divides user information into segments suitable for packaging into a series of ATM cells. AAL layer types are used as follows:

**AAL-1** - constant bit rate, time-dependent traffic such as voice and video

**AAL-2** - still undefined; a placeholder for variable bit rate video transmission

**AAL-3/4** - variable bit rate, delay-tolerant data traffic requiring some sequencing and/or error detection support (originally two AAL types, connection-oriented and connectionless, which have been combined)

**AAL-5** - variable bit rate, delay-tolerant, connection-oriented data traffic requiring minimal sequencing or error detection support

**ATM Address** - Defined in the UNI Specification as 3 formats, each having 20 bytes in length.

**ATM Forum** - an international non-profit organization formed with the objective of accelerating the use of ATM products and services through a rapid convergence of interoperability specifications. In addition, the Forum promotes industry cooperation and awareness.

**ATM Inverse Multiplexing (AIMUX)** - A device that allows multiple T1 or E1 communications facilities to be combined into a single broadband facility for the transmission of ATM cells.

**ATM Layer link** - a section of an ATM Layer connection between two adjacent active ATM Layer entities (ATM-entities).

**ATM Link** - a virtual path link (VPL) or a virtual channel link (VCL).

**ATM Management Interface (AMI)** - the user interface to FORE Systems' *ForeThought* switch control software (SCS). AMI lets users monitor and change various operating configurations of FORE Systems switches and network module hardware and software, IP connectivity, and SNMP network management.

**ATM Peer-to-Peer Connection** - a virtual channel connection (VCC) or a virtual path connection (VPC) directly established, such as workstation-to-workstation. This setup is not commonly used in networks.

**ATM Traffic Descriptor** - a generic list of parameters that can be used to capture the intrinsic traffic characteristics of a requested ATM connection.

**ATM User-to-User Connection** - an association established by the ATM Layer to support communication between two or more ATM service users (i.e., between two or more next higher layer entities or between two or more ATM entities). The communication over an ATM Layer connection may be either bidirectional or unidirectional. The same Virtual Channel Identifier (VCI) is used for both directions of a connection at an interface.

**atmarp** - a FORE program that shows and manipulates ATM ARP entries maintained by the given device driver. This is also used to establish PVC connections.

**ATM-attached Host Functional Group (AHFG)** - The group of functions performed by an ATM-attached host that is participating in the MPOA service.

**atmconfig** - a FORE program used to enable or disable SPANS signaling.

**atmstat** - a FORE program that shows statistics gathered about a given adapter card by the device driver. These statistics include ATM layer and ATM adaptation layer cell and error counts. This can also be used to query other hosts via SNMP.

**Attachment User Interface (AUI)** - IEEE 802.3 interface between a media attachment unit (MAU) and a network interface card (NIC). The term AUI can also refer to the rear panel port to which an AUI cable might attach.

**Auto-logout** - a feature that automatically logs out a user if there has been no user interface activity for a specified length of time.

**Automatic Protection Switching (APS)** - Equipment installed in communications systems to detect circuit failures and automatically switch to redundant, standby equipment.

**Available Bit Rate (ABR)** - a type of traffic for which the ATM network attempts to meet that traffic's bandwidth requirements. It does not guarantee a specific amount of bandwidth and the end station must retransmit any information that did not reach the far end.

**Backbone** - the main connectivity device of a distributed system. All systems that have connectivity to the backbone connect to each other, but systems can set up private arrangements with each other to bypass the backbone to improve cost, performance, or security.

**Backplane** - High-speed communications line to which individual components are connected.

**Backward Explicit Congestion Notification (BECN)** - A Resource Management cell type generated by the network or the destination, indicating congestion or approaching congestion for traffic flowing in the direction opposite that of the BECN cell.

**Bandwidth** - usually identifies the capacity or amount of data that can be sent through a given circuit; may be user-specified in a PVC.

**Baud** - unit of signalling speed, equal to the number of discrete conditions or signal events per second. If each signal event represents only one bit, the baud rate is the same as bps; if each signal event represents more than one bit (such as a dibit), the baud rate is smaller than bps.

**Bayonet-Neill-Concelman (BNC)** - a bayonet-locking connector used to terminate coaxial cables. BNC is also referred to as Bayonet Network Connector.

**Bipolar 8 Zero Substitution (B8ZS)** - a technique used to satisfy the ones density requirements of digital T-carrier facilities in the public network while allowing 64 Kbps clear channel data. Strings of eight consecutive zeroes are replaced by an eight-bit code representing two intentional bipolar pulse code violations (000V10V1).

**Bipolar Violation (BPV)** - an error event on a line in which the normal pattern of alternating high (one) and low (zero) signals is disrupted. A bipolar violation is noted when two high signals occur without an intervening low signal, or vice versa.

**B-ISDN Inter-Carrier Interface (B-ICI)** - An ATM Forum defined specification for the interface between public ATM networks to support user services across multiple public carriers.

**Bit Error Rate (BER)** - A measure of transmission quality, generally shown as a negative exponent, (e.g.,  $10^{-7}$  which means 1 out of  $10^7$  bits [1 out of 10,000,000 bits] are in error).

**Bit Interleaved Parity (BIP)** - an error-detection technique in which character bit patterns are forced into parity, so that the total number of one bits is always odd or always even. This is accomplished by the addition of a one or zero bit to each byte, as the byte is transmitted; at the other end of the transmission, the receiving device verifies the parity (odd or even) and the accuracy of the transmission.

**Bit Robbing** - The use of the least significant bit per channel in every sixth frame for signaling.

**Bit Stuffing** - A process in bit-oriented protocols where a zero is inserted into a string of ones by the sender to prevent the receiver from interpreting valid user data (the string of ones) as control characters (a Flag character for instance).

**Border Gateway Protocol (BGP)** - used by gateways in an internet connecting autonomous networks. It is derived from experiences learned using the EGP.

**bps** - bits per second

**Bridge** - a device that expands a Local Area Network by forwarding frames between data link layers associated with two separate cables, usually carrying a common protocol. Bridges can usually be made to filter certain packets (to forward only certain traffic).

**Bridge Protocol Data Unit (BPDU)** - A message type used by bridges to exchange management and control information.

**Broadband** - a service or system requiring transmission channels capable of supporting rates greater than the Integrated Services Digital Network (ISDN) primary rate.

**Broadband Access** - an ISDN access capable of supporting one or more broadband services.

**Broadband Connection Oriented Bearer (BCOB)** - Information in the SETUP message that indicates the type of service requested by the calling user.

**BCOB-A (Bearer Class A)** - Indicated by ATM end user in SETUP message for connection-oriented, constant bit rate service. The network may perform internetworking based on AAL information element (IE).

**BCOB-C (Bearer Class C)** - Indicated by ATM end user in SETUP message for connection-oriented, variable bit rate service. The network may perform internetworking based on AAL information element (IE).

**BCOB-X (Bearer Class X)** - Indicated by ATM end user in SETUP message for ATM transport service where AAL, traffic type and timing requirements are transparent to the network.

**Broadband Integrated Services Digital Network (B-ISDN)** - a common digital network suitable for voice, video, and high-speed data services running at rates beginning at 155 Mbps.

**Broadband ISDN User's Part (B-ISUP)** - A protocol used to establish, maintain and release broadband switched network connections across an SS7/ATM network.

**Broadband Terminal Equipment (B-TE)** - An equipment category for B-ISDN which includes terminal adapters and terminals.

**Broadcast** - Data transmission to all addresses or functions.

**Broadcast and Unknown Server (BUS)** - in an emulated LAN, the BUS is responsible for accepting broadcast, multicast, and unknown unicast packets from the LECs to the broadcast MAC address (FFFFFFFFFFFF) via dedicated point-to-point connections, and forwarding the packets to all of the members of the ELAN using a single point-to-multipoint connection.

**Router (bridging/router)** - a device that routes some protocols and bridges others based on configuration information.

**Buffer** - A data storage medium used to compensate of a difference in rate of data flow or time of occurrence of events when transmitting data from one device to another.

**Building Integrated Timing Supply (BITS)** - a master timing supply for an entire building, which is a master clock and its ancillary equipment. The BITS supplies DS1 and/or composite clock timing references for synchronization to all other clocks and timing sources in that building.

**Bursty Errored Seconds (BES)** - a BES contains more than 1 and fewer than 320 path coding violation error events, and no severely errored frame or AIS defects. Controlled slips are not included in determining BESs.

**Bursty Second** - a second during which there were at least the set number of BES threshold event errors but fewer than the set number of SES threshold event errors.

**Byte** - A computer-readable group of bits (normally 8 bits in length).

**Call** - an association between two or more users or between a user and a network entity that is established by the use of network capabilities. This association may have zero or more connections.

**Carrier** - a company, such as any of the "baby Bell" companies, that provide network communications services, either within a local area or between local areas.

**Carrier Group Alarm (CGA)** - A service alarm generated by a channel bank when an out-of-frame (OOF) condition exists for some predetermined length of time (generally 300 milliseconds to 2.5 seconds). The alarm causes the calls using a trunk to be dropped and trunk conditioning to be applied.

**Carrier Identification Parameter (CIP)** - A 3 or 4 digit code in the initial address message identifying the carrier to be used for the connection.

**cchan** - a FORE program that manages virtual channels on a *ForeRunner* switch running *asxd*.

**Cell** - an ATM Layer protocol data unit (PDU). The basic unit of information transported in ATM technology, each 53-byte cell contains a 5-byte header and a 48-byte payload.

**Cell Delay Variation (CDV)** - a quantification of cell clumping for a connection. The cell clumping CDV ( $\gamma_k$ ) is defined as the difference between a cell's expected reference arrival time ( $ck$ ) and its actual arrival time ( $ak$ ). The expected reference arrival time ( $ck$ ) of cell  $k$  of a specific connection is  $\max. T$  is the reciprocal of the negotiated peak cell rate.

**Cell Delineation** - the protocol for recognizing the beginning and end of ATM cells within the raw serial bit stream.

**Cell Header** - ATM Layer protocol control information.

**Cell Loss Priority (CLP)** - the last bit of byte four in an ATM cell header; indicates the eligibility of the cell for discard by the network under congested conditions. If the bit is set to 1, the cell may be discarded by the network depending on traffic conditions.

**Cell Loss Ratio** - In a network, cell loss ratio is  $(1-x/y)$ , where  $y$  is the number of cells that arrive in an interval at an ingress of the network; and  $x$  is the number of these  $y$  cells that leave at the egress of the network element.

**Cell Loss Ratio (CLR)** - CLR is a negotiated QoS parameter and acceptable values are network specific. The objective is to minimize CLR provided the end-system adapts the traffic to the changing ATM layer transfer characteristics. The Cell Loss Ratio is defined for a connection as: Lost Cells/Total Transmitted Cells. The CLR parameter is the value of CLR that the network agrees to offer as an objective over the lifetime of the connection. It is expressed as an order of magnitude, having a range of 10<sup>-1</sup> to 10<sup>-15</sup> and unspecified.

**Cell Misinsertion Rate (CMR)** - the ratio of cells received at an endpoint that were not originally transmitted by the source end in relation to the total number of cells properly transmitted.

**Cell Rate Adaptation (CRA)** - a function performed by a protocol module in which empty cells (known as unassigned cells) are added to the output stream. This is because there always must be a fixed number of cells in the output direction; when there are not enough cells to transmit, unassigned cells are added to the output data stream.

**Cell Relay Service (CRS)** - a carrier service which supports the receipt and transmission of ATM cells between end users in compliance with ATM standards and implementation specifications.

**Cell Transfer Delay** - the transit delay of an ATM cell successfully passed between two designated boundaries. See CTD.

**Cell Transfer Delay (CTD)** - This is defined as the elapsed time between a cell exit event at the measurement point 1 (e.g., at the source UNI) and the corresponding cell entry event at the measurement point 2 (e.g., the destination UNI) for a particular connection. The cell transfer delay between two measurement points is the sum of the total inter-ATM node transmission delay and the total ATM node processing delay.

**Channel** - A path or circuit along which information flows.

**Channel Associated Signaling (CAS)** - a form of circuit state signaling in which the circuit state is indicated by one or more bits of signaling status sent repetitively and associated with that specific circuit.

**Channel Bank** - A device that multiplexes many slow speed voice or data conversations onto high speed link and controls the flow.

**Channel Service Unit (CSU)** - An interface for digital leased lines which performs loopback testing and line conditioning.

**Channelization** - capability of transmitting independent signals together over a cable while still maintaining their separate identity for later separation.

**Circuit** - A communications link between points.

**Circuit Emulation Service (CES)** - The ATM Forum circuit emulation service interoperability specification specifies interoperability agreements for supporting Constant Bit Rate (CBR) traffic over ATM networks that comply with the other ATM Forum interoperability agreements. Specifically, this specification supports emulation of existing TDM circuits over ATM networks.

**Classical IP (CLIP)** - IP over ATM which conforms to RFC 1577.

**Clear to Send (CTS)** - and RS-232 modem interface control signal (sent from the modem to the DTE on pin 5) which indicates that the attached DTE may begin transmitting; issuance in response to the DTE's RTS.

**Clocking** - Regularly timed impulses.

**Closed User Group** - A subgroup of network users that can be its own entity; any member of the subgroup can only communicate with other members of that subgroup.

**Coaxial Cable** - Coax is a type of electrical communications medium used in the LAN environment. This cable consists of an outer conductor concentric to an inner conductor, separated from each other by insulating material, and covered by some protective outer material. This medium offers large bandwidth, supporting high data rates with high immunity to electrical interference and a low incidence of errors. Coax is subject to distance limitations and is relatively expensive and difficult to install.

**Cold Start Trap** - an SNMP trap which is sent after a power-cycle (see *trap*).

**Collision** - Overlapping transmissions that occur when two or more nodes on a LAN attempt to transmit at or about the same time.

**Committed Information Rate (CIR)** - CIR is the information transfer rate which a network offering Frame Relay Services (FRS) is committed to transfer under normal conditions. The rate is averaged over a minimum increment of time.

**Common Channel Signaling (CCS)** - A form signaling in which a group of circuits share a signaling channel. Refer to SS7.

**Common Management Interface Protocol (CMIP)** - An ITU-TSS standard for the message formats and procedures used to exchange management information in order to operate, administer maintain and provision a network.

**Concatenation** - The connection of transmission channels similar to a chain.

**Concentrator** - a communications device that offers the ability to concentrate many lower-speed channels into and out of one or more high-speed channels.

**Configuration** - The phase in which the LE Client discovers the LE Service.

**Congestion Management** - traffic management feature that helps ensure reasonable service for VBR connections in an ATM network, based on a priority, sustained cell rate (SCR), and peak cell rate (PCR). During times of congestion, bandwidth is reduced to the SCR, based on the priority of the connection.

**Connection** - the concatenation of ATM Layer links in order to provide an end-to-end information transfer capability to access points.

**Connection Admission Control (CAC)** - the procedure used to decide if a request for an ATM connection can be accepted based on the attributes of both the requested connection and the existing connections.

**Connection Endpoint (CE)** - a terminator at one end of a layer connection within a SAP.

**Connection Endpoint Identifier (CEI)** - an identifier of a CE that can be used to identify the connection at a SAP.

**Connectionless Broadband Data Service (CBDS)** - A connectionless service similar to Bellcore's SMDS defined by European Telecommunications Standards Institute (ETSI).

**Connectionless Service** - a type of service in which no pre-determined path or link has been established for transfer of information, supported by AAL 4.

**Connectionless Service (CLS)** - A service which allows the transfer of information among service subscribers without the need for end-to-end establishment procedures.

**Connection-Oriented Service** - a type of service in which information always traverses the same pre-established path or link between two points, supported by AAL 3.

**Constant Bit Rate (CBR)** - a type of traffic that requires a continuous, specific amount of bandwidth over the ATM network (e.g., digital information such as video and digitized voice).

**Controlled Slip (CS)** - a situation in which one frame's worth of data is either lost or replicated. A controlled slip typically occurs when the sending device and receiving device are not using the same clock.

**Convergence Sublayer (CS)** - a portion of the AAL. Data is passed first to the CS where it is divided into rational, fixed-length packets or PDUs (Protocol Data Units). For example, AAL 4 processes user data into blocks that are a maximum of 64 kbytes long.

**Corresponding Entities** - peer entities with a lower layer connection among them.

**cpath** - a FORE program used to manage virtual paths on a *ForeRunner* switch running asxd.

**cport** - a FORE program that monitors and changes the state of ports on a *ForeRunner* switch running *asxd*.

**Cross Connection** - a mapping between two channels or paths at a network device.

**Customer Premise Equipment (CPE)** - equipment that is on the customer side of the point of demarcation, as opposed to equipment that is on a carrier side. See also point of demarcation.

**Cut Through** - Establishment of a complete path for signaling and/or audio communications.

**Cyclic Redundancy Check (CRC)** - an error detection scheme in which a number is derived from the data that will be transmitted. By recalculating the CRC at the remote end and comparing it to the value originally transmitted, the receiving node can detect errors.

**D3/D4** - Refers to compliance with AT&T TR (Technical Reference) 62411 definitions for coding, supervision, and alarm support. D3/D4 compatibility ensures support of digital PBXes, M24 services, Megacom services, and Mode 3 D3/D4 channel banks at DS-1 level.

**D4 Channelization** - refers to compliance with AT&T Technical Reference 62411 regarding DS1 frame layout (the sequential assignment of channels and time slot numbers within the DS1).

**D4 Framed/Framing Format** - in T1, a 193-bit frame format in which the 193rd bit is used for framing and signaling information (the frame/framing bit). To be considered in support of D4 Framing, a device must be able to synchronize and frame-up on the 193rd bit.

**Data Communications Equipment (DCE)** - a definition in the RS232C standard that describes the functions of the signals and the physical characteristics of an interface for a communication device such as a modem.

**Data Country Code (DCC)** - This specifies the country in which an address is registered. The codes are given in ISO 3166. The length of this field is two octets. The digits of the data country code are encoded in Binary Coded Decimal (BCD) syntax. The codes will be left justified and padded on the right with the hexadecimal value "F" to fill the two octets.

**Data Link** - Communications connection used to transmit data from a source to a destination.

**Data Link Connection Identifier (DLCI)** - connection identifier associated with frame relay packets that serves the same functions as, and translates directly to, the VPI/VCI on an ATM cell.

**Data Link Layer** - Layer 2 of the OSI model, responsible for encoding data and passing it to the physical medium. The IEEE divides this layer into the LLC (Logical Link Control) and MAC (Media Access Control) sublayers.

**Data Set Ready (DSR)** - an RS-232 modem interface control signal (sent from the modem to the DTE on pin 6) which indicates that the modem is connected to the telephone circuit. Usually a prerequisite to the DTE issuing RTS.

**Data Terminal Equipment (DTE)** - generally user devices, such as terminals and computers, that connect to data circuit-terminating equipment. They either generate or receive the data carried by the network.

**Data Terminal Ready (DTR)** - an RS232 modem interface control signal (sent from the DTE to the modem on pin 20) which indicates that the DTE is ready for data transmission and which requests that the modem be connected to the telephone circuit.

**Datagram** - a packet of information used in a connectionless network service that is routed to its destination using an address included in the datagram's header.

**DECnet** - Digital Equipment Corporation's proprietary LAN.

**Defense Advanced Research Projects Agency (DARPA)** - the US government agency that funded the ARPANET.

**Demultiplexing** - a function performed by a layer entity that identifies and separates SDUs from a single connection to more than one connection (see *multiplexing*).

**Destination End Station (DES)** - An ATM termination point which is the destination for ATM messages of a connection and is used as a reference point for ABR services. See SES.

**Digital Access and Cross-Connect System (DACS)** - Digital switching system for routing T1 lines, and DS-0 portions of lines, among multiple T1 ports.

**Digital Cross-connect System (DCS)** - an electronic patch panel used to route digital signals in a central office.

**Digital Standard n (0, 1, 1C, 2, and 3) (DSn)** - a method defining the rate and format of digital hierarchy, with asynchronous data rates defined as follows:

DS0	64kb/s	1 voice channel
DS1	1.544Mb/s	24 DS0s
DS1C	3.152 Mb/s	2 DS1s
DS2	6.312 Mb/s	4 DS1s
DS3	44.736 Mb/s	28 DS1s

Synchronous data rates (SONET) are defined as:

STS-1/OC-1	51.84 Mb/s	28 DS1s or 1 DS3
STS-3/OC-3	155.52 Mb/s	3 STS-1s byte interleaved
STS-3c/OC-3c	155.52 Mb/s	Concatenated, indivisible payload
STS-12/OC-12	622.08 Mb/s	12 STS-1s, 4 STS-3cs, or any mixture
STS-12c/OC-12c	622.08 Mb/s	Concatenated, indivisible payload
STS-48/OC-48	2488.32 Mb/s	48 STS-1s, 16 STS-3cs, or any mixture

**DIP (Dual In-line Package) Switch** - a device that has two parallel rows of contacts that let the user switch electrical current through a pair of those contacts to on or off. They are used to reconfigure components and peripherals.

**Domain Name Server** - a computer that converts names to their corresponding Internet numbers. It allows users to telnet or FTP to the name instead of the number.

**Domain Naming System (DNS)** - the distributed name and address mechanism used in the Internet.

**Duplex** - Two way communication.

**DXI** - a generic phrase used in the full names of several protocols, all commonly used to allow a pair of DCE and DTE devices to share the implementation of a particular WAN protocol. The protocols define the packet formats used to transport data between DCE and DTE devices.

**DXI Frame Address (DFA)** - a connection identifier associated with ATM DXI packets that serves the same functions as, and translates directly to, the VPI/VCI on an ATM cell.

**Dynamic Allocation** - A technique in which the resources assigned for program execution are determined by criteria applied at the moment of need.

**E.164** - A public network addressing standard utilizing up to a maximum of 15 digits. ATM uses E.164 addressing for public network addressing.

**E1** - Wide-area digital transmission scheme used predominantly in Europe that carries data at a rate of 2.048 Mbps. E1 lines can be leased for private use from common carriers.

**E3** - Wide-area digital transmission scheme used predominantly in Europe that carries data at a rate of 34.368 Mbps. E3 lines can be leased for private use from common carriers.

**Edge Device** - A physical device which is capable of forwarding packets between legacy inter-working interfaces (e.g., Ethernet, Token Ring, etc.) and ATM interfaces based on data-link and network layer information but which does not participate in the running of any network layer routing protocol. An Edge Device obtains forwarding descriptions using the route distribution protocol.

**elarp** - a FORE program that shows and manipulates MAC and ATM address mappings for LAN Emulation Clients (LECs).

**elconfig** - a FORE program that shows and modifies LEC configuration. Lets the user set the NSAP address of the LAN Emulation Configuration Server, display the list of Emulated LANs configured in the LECS for this host, display the list of ELANs locally configured along with the membership state of each, and locally administer ELAN membership.

**Electrically Erasable Programmable Read Only Memory (EEPROM)** - an EPROM that can be cleared with electrical signals rather than the traditional ultraviolet light.

**Electromagnetic Interference (EMI)** - signals generated and radiated by an electronic device that cause interference with radio communications, among other effects.

**Electronics Industries Association (EIA)** - a USA trade organization that issues its own standards and contributes to ANSI; developed RS-232. Membership includes USA manufacturers.

**Embedded SNMP Agent** - an SNMP agent can come in two forms: embedded or proxy. An embedded SNMP agent is integrated into the physical hardware and software of the unit.

**Emulated Local Area Network (ELAN)** - A logical network initiated by using the mechanisms defined by LAN Emulation. This could include ATM and legacy attached end stations.

**End System (ES)** - a system where an ATM connection is terminated or initiated (an originating end system initiates the connection; a terminating end system terminates the connection).

**End System Identifier (ESI)** - This identifier distinguishes multiple nodes at the same level in case the lower level peer group is partitioned.

**End-to-End Connection** - when used in reference to an ATM network, a connection that travels through an ATM network, passing through various ATM devices and with endpoints at the termination of the ATM network.

**Enterprise** - Terminology generally referring to customers with multiple, non-contiguous geographic locations.

**Equalization (EQL)** - the process of compensating for line distortions.

**Erasable Programmable Read Only Memory (EPROM)** - A PROM which may be erased and rewritten to perform new or different functions (normally done with a PROM burner).

**Errored Second (ES)** - a second during which at least one code violation occurred.

**Ethernet** - a 10-Mbps, coaxial standard for LANs in which all nodes connect to the cable where they contend for access.

**Excessive Zeroes (EXZ) Error Event** - An Excessive Zeroes error event for an AMI-coded signal is the occurrence of more than fifteen contiguous zeroes. For a B8ZS coded signal, the defect occurs when more than seven contiguous zeroes are detected.

**Explicit Forward Congestion Indication (EFCI)** - the second bit of the payload type field in the header of an ATM cell, the EFCI bit indicates network congestion to receiving hosts. On a congested switch, the EFCI bit is set to "1" by the transmitting network module when a certain number of cells have accumulated in the network module's shared memory buffer. When a cell is received that has its EFCI bit set to "1," the receiving host notifies the sending host, which should then reduce its transmission rate.

**Explicit Rate (ER)** - The Explicit Rate is an RM-cell field used to limit the source ACR to a specific value. It is initially set by the source to a requested rate (such as PCR). It may be subsequently reduced by any network element in the path to a value that the element can sustain. ER is formatted as a rate.

**Extended Industry Standard Architecture (EISA)** - bus architecture for desktop computers that provides a 32-bit data passage and maintains compatibility with the ISA or AT architecture.

**Extended Super Frame (ESF)** - a T1 framing format that utilizes the 193rd bit as a framing bit, but whose Superframe is made up of 24 frames instead of 12 as in D4 format. ESF also provides CRC error detection and maintenance data link functions.

**Exterior Gateway Protocol (EGP)** - used by gateways in an internet, connecting autonomous networks.

**Fairness** - related to Generic Flow Control, fairness is defined as meeting all of the agreed quality of service requirements by controlling the order of service for all active connections.

**Far End Block Error (FEBE)** - an error detected by extracting the 4-bit FEBE field from the path status byte (G1). The legal range for the 4-bit field is between 0000 and 1000, representing zero to eight errors. Any other value is interpreted as zero errors.

**Far End Receive Failure (FERF)** - a line error asserted when a 110 binary pattern is detected in bits 6, 7, 8 of the K2 byte for five consecutive frames. A line FERF is removed when any pattern other than 110 is detected in these bits for five consecutive frames.

**Far-End** - in a relationship between two devices in a circuit, the far-end device is the one that is remote.

**Face Contact (FC)** - Designation for fiber optic connector designed by Nippon Telegraph and Telephone which features a movable anti-rotation key allowing good repeatable performance despite numerous mating. Normally referred to as Fiber Connector, FC actually stands for Face Contact and sometimes linked with PC (Point Contact), designated as FC or FC-PC.

**FCC Part 68** - The FCC rules regulating the direct connection of non-telephone company provided equipment to the public telephone network.

**Federal Communications Commission (FCC)** - a board of commissioners appointed by the President under the Communications Act of 1934, with the authority to regulate all interstate telecommunications originating in the United States, including transmission over phone lines.

**Fiber Distributed Data Interface (FDDI)** - high-speed data network that uses fiber-optic as the physical medium. Operates in similar manner to Ethernet or Token Ring, only faster.

**File Transfer Protocol (FTP)** - a TCP/IP protocol that lets a user on one computer access, and transfer data to and from, another computer over a network. ftp is usually the name of the program the user invokes to accomplish this task.

**First-In, First-Out (FIFO)** - method of coordinating the sequential flow of data through a buffer.

**Flag** - a bit pattern of six binary "1"s bounded by a binary "0" at each end (forms a 0111 1110 or Hex "7E"). It is used to mark the beginning and/or end of a frame.

**Flow Control** - The way in which information is controlled in a network to prevent loss of data when the receiving buffer is near its capacity.

**ForeThought PNNI (FT-PNNI)** - a FORE Systems routing and signalling protocol that uses private ATM (NSAP) addresses; a precursor to ATM Forum PNNI (see PNNI).

**Forward Error Correction (FEC)** - A technique used by a receiver for correcting errors incurred in transmission over a communications channel without requiring retransmission of any information by the transmitter; typically involves a convolution of the transmitted bits and the appending of extra bits by both the receiver and transmitter using a common algorithm.

**Forward Explicit Congestion Notification (FECN)** - Bit set by a Frame Relay network to inform data terminal equipment (DTE) receiving the frame that congestion was experienced in the path from source to destination. DTE receiving frames with the FECN bit set can request that higher-level protocols take flow control action as appropriate.

**Fractional T1** - the use of bandwidth in 64Kbps increments up to 1.544Mbps from a T1 facility.

**Frame** - a variable length group of data bits with a specific format containing flags at the beginning and end to provide demarcation.

**Frame Check Sequence (FCS)** - In bit-oriented protocols, a 16-bit field that contains transmission error checking information, usually appended to the end of the frame.

**Frame Relay** - a fast packet switching protocol based on the LAPD protocol of ISDN that performs routing and transfer with less overhead processing than X.25.

**Frame Synchronization Error** - an error in which one or more time slot framing bits are in error.

**Frame-Based UNI (FUNI)** - An ATM switch-based interface which accepts frame-based ATM traffic and converts it into cells.

**Frame-Relay Service (FRS)** - A connection oriented service that is capable of carrying up to 4096 bytes per frame.

**Framing** - a protocol that separates incoming bits into identifiable groups so that the receiving multiplexer recognizes the grouping.

**Frequency Division Multiplexing (FDM)** - a method of dividing an available frequency range into parts with each having enough bandwidth to carry one channel.

**Gbps** - gigabits per second (billion)

**Generic Cell Rate Algorithm (GCRA)** - an algorithm which is employed in traffic policing and is part of the user/network service contract. The GCRA is a scheduling algorithm which ensures that cells are marked as conforming when they arrive when expected or later than expected and non-conforming when they arrive sooner than expected.

**Generic Connection Admission Control (GCAC)** - This is a process to determine if a link has potentially enough resources to support a connection.

**Generic Flow Control (GFC)** - the first four bits of the first byte in an ATM cell header. Used to control the flow of traffic across the User-to-Network Interface (UNI), and thus into the network. Exact mechanisms for flow control are still under investigation and no explicit definition for this field exists at this time. (This field is used only at the UNI; for NNI-NNI use (between network nodes), these four bits provide additional network address capacity, and are appended to the VPI field.)

**GIO** - a proprietary bus architecture used in certain Silicon Graphics, Inc. workstations.

**Header** - protocol control information located at the beginning of a protocol data unit.

**Header Error Control (HEC)** - a CRC code located in the last byte of an ATM cell header that is used for checking cell header integrity only.

**High Density Bipolar (HDB3)** - A bipolar coding method that does not allow more than 3 consecutive zeroes.

**High Level Data Link Control (HDLC)** - An ITU-TSS link layer protocol standard for point-to-point and multi-point communications.

**High Performance Parallel Interface (HIPPI)** - ANSI standard that extends the computer bus over fairly short distances at speeds of 800 and 1600 Mbps.

**High-Speed Serial Interface (HSSI)** - a serial communications connection that operates at speeds of up to 1.544 Mbps.

**Host** - In a network, the primary or controlling computer in a multiple computer installation.

**HPUX** - the Hewlett-Packard version of UNIX.

**Hub** - a device that connects several other devices, usually in a star topology.

**I/O Module** - FORE's interface cards for the LAX-20 LAN Access Switch, designed to connect Ethernet, Token Ring, and FDDI LANs to *ForeRunner* ATM networks.

**Institute of Electrical and Electronics Engineers (IEEE)** - the world's largest technical professional society. Based in the U.S., the IEEE sponsors technical conferences, symposia & local meetings worldwide, publishes nearly 25% of the world's technical papers in electrical, electronics & computer engineering, provides educational programs for members, and promotes standardization.

**IEEE 802** - Standards for the interconnection of LAN computer equipment. Deals with the Data Link Layers of the ISO Reference Model for OSI.

**IEEE 802.1** - Defines the high-level network interfaces such as architecture, internetworking and network management.

**IEEE 802.2** - Defines the Logical Link Control interface between the Data Link and Network Layers.

**IEEE 802.3** - Defines CSMA/CD (Ethernet).

**IEEE 802.4** - Defines the token-passing bus.

**IEEE 802.5** - Defines the Token Ring access methodology. This standard incorporates IBM's Token Ring specifications.

**IEEE 802.6** - Defines Metropolitan Area Networks.

**IEEE 802.7** - The broadband technical advisory group.

**IEEE 802.8** - The fiber optics technical advisory group.

**IEEE 802.9** - Defines integrated data and voice networks.

**Integrated Services Digital Network (ISDN)** - an emerging technology that is beginning to be offered by the telephone carriers of the world. ISDN combines voice and digital network services into a single medium or wire.

**Interexchange Carriers (IXC)** - Long-distance communications companies that provide service between Local Access Transport Areas (LATAs).

**Interface Data** - the unit of information transferred to/from the upper layer in a single interaction across a SAP. Each Interface Data Unit (IDU) controls interface information and may also contain the whole or part of the SDU.

**Interface Data Unit (IDU)** - The unit of information transferred to/from the upper layer in a single interaction across the SAP. Each IDU contains interface control information and may also contain the whole or part of the SDU.

**Interim Local Management Interface (ILMI)** - the standard that specifies the use of the Simple Network Management Protocol (SNMP) and an ATM management information base (MIB) to provide network status and configuration information.

**Intermediate System (IS)** - a system that provides forwarding functions or relaying functions or both for a specific ATM connection. OAM cells may be generated and received.

**International Standards Organization (ISO)** - a voluntary, non treaty organization founded in 1946 that is responsible for creating international standards in many areas, including computers and communications.

**International Telephone and Telegraph Consultative Committee (CCITT)** - the international standards body for telecommunications.

**Internet** - (note the capital "I") the largest internet in the world including large national backbone nets and many regional and local networks worldwide. The Internet uses the TCP/IP suite. Networks with only e-mail connectivity are not considered on the Internet.

**internet** - while an internet is a network, the term "internet" is usually used to refer to a collection of networks interconnected with routers.

**Internet Addresses** - the numbers used to identify hosts on an internet network. Internet host numbers are divided into two parts; the first is the network number and the second, or local, part is a host number on that particular network. There are also three classes of networks in the Internet, based on the number of hosts on a given network. Large networks are classified as Class A, having addresses in the range 1-126 and having a maximum of 16,387,064 hosts. Medium networks are classified as Class B, with addresses in the range 128-191 and with a maximum of 64,516 hosts. Small networks are classified as Class C, having addresses in the range 192-254 with a maximum of 254 hosts. Addresses are given as dotted decimal numbers in the following format:

nnn.nnn.nnn.nnn

In a Class A network, the first of the numbers is the network number, the last three numbers are the local host address.

In a Class B network, the first two numbers are the network, the last two are the local host address.

In a Class C network, the first three numbers are the network address, the last number is the local host address.

The following table summarizes the classes and sizes:

Class	First #	Max# Hosts
A	1-126	16,387,064
B	129-191	64,516
C	192-223	254

Network mask values are used to identify the network portion and the host portion of the address. Default network masks are as follows:

Class A - 255.0.0.0

Class B - 255.255.0.0

Class C - 255.255.255.0

Subnet masking is used when a portion of the host ID is used to identify a subnetwork. For example, if a portion of a Class B network address is used for a subnetwork, the mask could be set as 255.255.255.0. This would allow the third byte to be used as a subnetwork address. All hosts on the network would still use the IP address to get on the Internet.

**Internet Control Message Protocol (ICMP)** - the protocol that handles errors and control messages at the IP layer. ICMP is actually a part of the IP protocol layer. It can generate error messages, test packets, and informational messages related to IP.

**Internet Engineering Task Force (IETF)** - a large, open, international community of network designers, operators, vendors and researchers whose purpose is to coordinate the operation, management and evolution of the Internet to resolve short- and mid-range protocol and architectural issues.

**Internet Protocol (IP)** - a connectionless, best-effort packet switching protocol that offers a common layer over dissimilar networks.

**Internetwork Packet Exchange (IPX) Protocol** - a NetWare protocol similar to the Xerox Network Systems (XNS) protocol that provides datagram delivery of messages.

**Interoperability** - The ability of software and hardware on multiple machines, from multiple vendors, to communicate.

**Interworking Function (IWF)** - provides a means for two different technologies to interoperate.

**IP Address** - a unique 32-bit integer used to identify a device in an IP network. You will most commonly see IP addresses written in "dot" notation (e.g., 192.228.32.14).

**IP Netmask** - a 32-bit pattern that is combined with an IP address to determine which bits of an IP address denote the network number and which denote the host number. Netmasks are useful for sub-dividing IP networks. IP netmasks are written in "dot" notation (e.g., 255.255.0.0).

**ISA Bus** - a bus standard developed by IBM for expansion cards in the first IBM PC. The original bus supported a data path only 8 bits wide. IBM subsequently developed a 16-bit version for its AT class computers. The 16-bit AT ISA bus supports both 8- and 16-bit cards. The 8-bit bus is commonly called the PC/XT bus, and the 16-bit bus is called the AT bus.

**Isochronous** - signals carrying embedded timing information or signals that are dependent on uniform timing; usually associated with voice and/or video transmission.

**International Telecommunications Union Telecommunications (ITU-T)** - an international body of member countries whose task is to define recommendations and standards relating to the international telecommunications industry. The fundamental standards for ATM have been defined and published by the ITU-T (Previously CCITT).

**J2** - Wide-area digital transmission scheme used predominantly in Japan that carries data at a rate of 6.312 Mbps.

**Jitter** - analog communication line distortion caused by variations of a signal from its reference timing position.

**Joint Photographic Experts Group (JPEG)** - An ISO Standards group that defines how to compress still pictures.

**Jumper** - a patch cable or wire used to establish a circuit, often temporarily, for testing or diagnostics; also, the devices, shorting blocks, used to connect adjacent exposed pins on a printed circuit board that control the functionality of the card.

**Kbps** - kilobits per second (thousand)

**LAN Access Concentrator** - a LAN access device that allows a shared transmission medium to accommodate more data sources than there are channels currently available within the transmission medium.

**LAN Emulation Address Resolution Protocol (LE\_ARP)** - A message issued by a LE client to solicit the ATM address of another function.

**LAN Emulation Client (LEC)** - the component in an end system that performs data forwarding, address resolution, and other control functions when communicating with other components within an ELAN.

**LAN Emulation Configuration Server (LECS)** - the LECS is responsible for the initial configuration of LECs. It provides information about available ELANs that a LEC may join, together with the addresses of the LES and BUS associated with each ELAN.

**LAN Emulation Server (LES)** - the LES implements the control coordination function for an ELAN by registering and resolving MAC addresses to ATM addresses.

**LAN Emulation (LANE)** - technology that allows an ATM network to function as a LAN backbone. The ATM network must provide multicast and broadcast support, address mapping (MAC-to-ATM), SVC management, and a usable packet format. LANE also defines Ethernet and Token Ring ELANs.

**lane** - a program that provides control over the execution of the LAN Emulation Server (LES), Broadcast/Unknown Server (BUS), and LAN Emulation Configuration Server (LECS) on the local host.

**Latency** - The time interval between a network station seeking access to a transmission channel and that access being granted or received.

**Layer Entity** - an active layer within an element.

**Layer Function** - a part of the activity of the layer entities.

**Layer Service** - a capability of a layer and the layers beneath it that is provided to the upper layer entities at the boundary between that layer and the next higher layer.

**Layer User Data** - the information transferred between corresponding entities on behalf of the upper layer or layer management entities for which they are providing services.

**le** - a FORE program that implements both the LAN Emulation Server (LES) and the Broadcast/Unknown Server (BUS).

**Leaky Bucket** - informal cell policing term for the Generic Cell Rate Algorithm which in effect receives cells into a bucket and leaks them out at the specified or contracted rate (i.e., PCR).

**Least Significant Bit (LSB)** - lowest order bit in the binary representation of a numerical value.

**lecs** - a FORE program that implements the assignment of individual LECs to different emulated LANs.

**leq** - a FORE program that provides information about an ELAN. This information is obtained from the LES, and includes MAC addresses registered on the ELAN together with their corresponding ATM addresses.

**Line Build Out (LBO)** - Because T1 circuits require the last span to lose 15-22.5 dB, a selectable output attenuation is generally required of DTE equipment (typical selections include 0.0, 7.5 and 15 dB of loss at 772 KHz).

**Line Code Violations (LCV)** - Error Event. A Line Coding Violation (LCV) is the occurrence of either a Bipolar Violation (BPV) or Excessive Zeroes (EXZ) Error Event.

**Link** - An entity that defines a topological relationship (including available transport capacity) between two nodes in different subnetworks. Multiple links may exist between a pair of subnetworks. Synonymous with logical link.

**Link Access Procedure, Balanced (LAPB)** - Data link protocol in the X.25 protocol stack. LAPB is a bit-oriented protocol derived from HDLC. See also HDLC and X.25.

**Link Down Trap** - an SNMP trap, sent when an interface changes from a normal state to an error state, or is disconnected.

**Link Layer** - layer in the OSI model regarding transmission of data between network nodes.

**Link Up Trap** - an SNMP trap, sent when an interface changes from an error condition to a normal state.

**Load Sharing** - Two or more computers in a system that share the load during peak hours. During periods of non peak hours, one computer can manage the entire load with the other acting as a backup.

**Local Access and Transport Area (LATA)** - Geographic boundaries of the local telephone network, specified by the FCC, in which a single LEC may perform its operations. Communications outside or between LATAs are provided by IXC's.

**Local Area Network (LAN)** - a data network intended to serve an area of only a few square kilometers or less. Because the network is known to cover only a small area, optimizations can be made in the network signal protocols that permit higher data rates.

**Logical Link Control (LLC)** - protocol developed by the IEEE 802 committee for data-link-layer transmission control; the upper sublayer of the IEEE Layer 2 (OSI) protocol that complements the MAC protocol; IEEE standard 802.2; includes end-system addressing and error checking.

**Loopback** - a troubleshooting technique that returns a transmitted signal to its source so that the signal can be analyzed for errors. Typically, a loopback is set at various points in a line until the section of the line that is causing the problem is discovered.

**looptest** - program that tests an interface for basic cell reception and transmission functionality, usually used for diagnostic purposes to determine if an interface is functioning properly.

**Loss Of Frame (LOF)** - a type of transmission error that may occur in wide-area carrier lines.

**Loss Of Pointer (LOP)** - a type of transmission error that may occur in wide-area carrier lines.

**Loss Of Signal (LOS)** - a type of transmission error that may occur in wide-area carrier lines, or a condition declared when the DTE senses a loss of a DS1 signal from the CPE for more than 150 milliseconds (the DTE generally responds with an all ones "Blue or AIS" signal).

**Management Information Base (MIB)** - the set of parameters that an SNMP management station can query or set in the SNMP agent of a networked device (e.g., router).

**Maximum Burst Size (MBS)** - the Burst Tolerance (BT) is conveyed through the MBS which is coded as a number of cells. The BT together with the SCR and the GCRA determine the MBS that may be transmitted at the peak rate and still be in conformance with the GCRA.

**Maximum Burst Tolerance** - the largest burst of data that a network device is guaranteed to handle without discarding cells or packets. Bursts of data larger than the maximum burst size may be subject to discard.

**Maximum Cell Delay Variance (MCDV)** - This is the maximum two-point CDV objective across a link or node for the specified service category.

**Maximum Cell Loss Ratio (MCLR)** - This is the maximum ratio of the number of cells that do not make it across the link or node to the total number of cells arriving at the link or node.

**Maximum Cell Transfer Delay (MCTD)** - This is the sum of the fixed delay component across the link or node and MCDV.

**Maximum Transmission Unit (MTU)** - the largest unit of data that can be sent over a type of physical medium.

**Mbps** - megabits per second (million)

**Media Access Control (MAC)** - a media-specific access control protocol within IEEE 802 specifications; currently includes variations for Token Ring, token bus, and CSMA/CD; the lower sublayer of the IEEE's link layer (OSI), which complements the Logical Link Control (LLC).

**Media Attachment Unit (MAU)** - device used in Ethernet and IEEE 802.3 networks that provides the interface between the AUI port of a station and the common medium of the Ethernet. The MAU, which can be built into a station or can be a separate device, performs physical layer functions including conversion of the digital data from the Ethernet interface, collision detection, and injection of bits onto the network.

- Media Interface Connector (MIC)** - fiber optic connector that joins fiber to the FDDI controller.
- Message Identifier (MID)** - message identifier used to associate ATM cells that carry segments from the same higher layer packet.
- Metasignalling** - an ATM Layer Management (LM) process that manages different types of signalling and possibly semipermanent virtual channels (VCs), including the assignment, removal, and checking of VCs.
- Metasignalling VCs** - the standardized VCs that convey metasignalling information across a User-to-Network Interface (UNI).
- Metropolitan Area Network (MAN)** - network designed to carry data over an area larger than a campus such as an entire city and its outlying area.
- MicroChannel** - a proprietary 16- or 32-bit bus developed by IBM for its PS/2 computers' internal expansion cards; also offered by others.
- Minimum Cell Rate (MCR)** - parameter defined by the ATM Forum for ATM traffic management, defined only for ABR transmissions and specifying the minimum value for the ACR.
- Most Significant Bit (MSB)** - highest order bit in the binary representation of a numerical value.
- Motion Picture Experts Group (MPEG)** - ISO group dealing with video and audio compression techniques and mechanisms for multiplexing and synchronizing various media streams.
- MPOA Client** - A device which implements the client side of one or more of the MPOA protocols, (i.e., is a SCP client and/or an RDP client. An MPOA Client is either an Edge Device Functional Group (EDFG) or a Host Behavior Functional Group (HBFG).
- MPOA Server** - An MPOA Server is any one of an ICFG or RSFG.
- MPOA Service Area** - The collection of server functions and their clients. A collection of physical devices consisting of an MPOA server plus the set of clients served by that server.
- MPOA Target** - A set of protocol address, path attributes, (e.g., internetwork layer QoS, other information derivable from received packet) describing the intended destination and its path attributes that MPOA devices may use as lookup keys.
- Mu-Law** - The PCM coding and companding standard used in Japan and North America.
- Multicasting** - The ability to broadcast messages to one node or a select group of nodes.
- Multi-homed** - a device having both an ATM and another network connection, like Ethernet.
- Multimode Fiber Optic Cable (MMF)** - fiber optic cable in which the signal or light propagates in multiple modes or paths. Since these paths may have varying lengths, a transmitted pulse of light may be received at different times and smeared to the point that pulses may interfere with surrounding pulses. This may cause the signal to be difficult or impossible to receive. This pulse dispersion sometimes limits the distance over which a MMF link can operate.
- Multiplexing** - a function within a layer that interleaves the information from multiple connections into one connection (see demultiplexing).

**Multipoint Access** - user access in which more than one terminal equipment (TE) is supported by a single network termination.

**Multipoint-to-Multipoint Connection** - a collection of associated ATM VC or VP links, and their associated endpoint nodes, with the following properties:

1. All N nodes in the connection, called Endpoints, serve as a Root Node in a Point-to-Multipoint connection to all of the (N-1) remaining endpoints.
2. Each of the endpoints can send information directly to any other endpoint, but the receiving endpoint cannot distinguish which of the endpoints is sending information without additional (e.g., higher layer) information.

**Multipoint-to-Point Connection** - a Point-to-Multipoint Connection may have zero bandwidth from the Root Node to the Leaf Nodes, and non-zero return bandwidth from the Leaf Nodes to the Root Node. Such a connection is also known as a Multipoint-to-Point Connection.

**Multiprotocol over ATM (MPOA)** - An effort taking place in the ATM Forum to standardize protocols for the purpose of running multiple network layer protocols over ATM.

**Narrowband Channel** - sub-voicegrade channel with a speed range of 100 to 200 bps.

**National TV Standards Committee (NTSC)** - Started in the US in 1953 from a specification laid down by the National Television Standards Committee. It takes the B-Y and R-Y color difference signals, attenuates them to I and Q, then modulates them using double-sideband suppressed subcarrier at 3.58MHz. The carrier reference is sent to the receiver as a burst during the back porch. An industry group that defines how television signals are encoded and transmitted in the US. (See also PAL, SECAM for non-U.S. countries).

**Near-End** - in a relationship between two devices in a circuit, the near-end device is the one that is local.

**Network Layer** - Layer three In the OSI model, the layer that is responsible for routing data across the network.

**Network Management Entity (NM)** - body of software in a switching system that provides the ability to manage the PNNI protocol. NM interacts with the PNNI protocol through the MIB.

**Network Management Layer (NML)** - an abstraction of the functions provided by systems which manage network elements on a collective basis, providing end-to-end network monitoring.

**Network Management Station (NMS)** - system responsible for managing a network or portion of a network by talking to network management agents, which reside in the managed nodes.

**Network Module** - ATM port interface cards which may be individually added to or removed from any *ForeRunner* ATM switch to provide a diverse choice of connection alternatives.

**Network Parameter Control (NPC)** - Defined as the set of actions taken by the network to monitor and control traffic from the NNI. Its main purpose is to protect network resources from malicious as well as unintentional misbehavior which can affect the QoS of other already established connections by detecting violations of negotiated parameters and taking appropriate actions. Refer to UPC.

**Network Redundancy** - Duplicated network equipment and/or data which can provide a backup in case of network failures.

**Network Service Access Point (NSAP)** - OSI generic standard for a network address consisting of 20 octets. ATM has specified E.164 for public network addressing and the NSAP address structure for private network addresses.

**Network-to-Network Interface or Network Node Interface (NNI)** - the interface between two public network pieces of equipment.

**Node** - A computer or other device when considered as part of a network.

**Non Return to Zero (NRZ)** - a binary encoding scheme in which ones and zeroes are represented by opposite and alternating high and low voltages and where there is no return to a zero (reference) voltage between encoded bits.

**Non Return to Zero Inverted (NRZI)** - A binary encoding scheme that inverts the signal on a "1" and leaves the signal unchanged for a "0". (Also called transition encoding.)

**Nonvolatile Storage** - Memory storage that does not lose its contents when power is turned off.

**NuBus** - a high-speed bus used in Macintosh computers, structured so users can put a card into any slot on the board without creating conflict over the priority between those cards.

**nx64K** - This refers to a circuit bandwidth or speed provided by the aggregation of nx64 kbps channels (where n= integer > 1). The 64K or DS0 channel is the basic rate provided by the T Carrier systems.

**Nyquist Theorem** - In communications theory, a formula stating that two samples per cycle is sufficient to characterize a bandwidth limited analog signal; in other words, the sampling rate must be twice the highest frequency component of the signal (i.e., sample 4 KHz analog voice channels 8000 times per second).

**Object Identifier (OID)** - the address of a MIB variable.

**Octet** - a grouping of 8 bits; similar, but not identical to, a byte.

**One's Density** - The requirement for digital transmission lines in the public switched telephone network that eight consecutive "0"s cannot be in a digital data stream; exists because repeaters and clocking devices within the network will lose timing after receiving eight "0"s in a row; a number of techniques are used to insert a "1" after every seventh-consecutive "0" (see Bit Stuffing).

**Open Shortest Path First (OSPF) Protocol** - a routing algorithm for IP that incorporates least-cost, equal-cost, and load balancing.

**Open Systems Interconnection (OSI)** - the 7-layer suite of protocols designed by ISO committees to be the international standard computer network architecture.

**OpenView** - Hewlett-Packard's network management software.

**Operation and Maintenance (OAM) Cell** - a cell that contains ATM LM information. It does not form part of the upper layer information transfer.

**Optical Carrier level-n (OC-n)** - The optical counterpart of STS-n (the basic rate of 51.84 Mbps on which SONET is based is referred to as OC-1 or STS-1).

**Organizationally Unique Identifier (OUI)** - Part of RFC 1483. A three-octet field in the SubNetwork Attachment Point (SNAP) header, identifying an organization which administers the meaning of the following two octet Protocol Identifier (PID) field in the SNAP header. Together they identify a distinct routed or bridged protocol.

**Out-of-Band Management** - refers to switch configuration via the serial port or over Ethernet, not ATM.

**Out-of-Frame (OOF)** - a signal condition and alarm in which some or all framing bits are lost.

**Packet** - An arbitrary collection of data grouped and transmitted with its user identification over a shared facility.

**Packet Assembler Disassembler (PAD)** - interface device that buffers data sent to/from character mode devices, and assembles and disassembles the packets needed for X.25 operation.

**Packet Internet Groper (ping)** - a program used to test reachability of destinations by sending them an ICMP echo request and waiting for a reply.

**Packet Level Protocol (PLP)** - Network layer protocol in the X.25 protocol stack. Sometimes called X.25 Level 3 or X.25 Protocol.

**Packet Switched Network (PSN)** - a network designed to carry data in the form of packets. The packet and its format is internal to that network.

**Packet Switching** - a communications paradigm in which packets (messages) are individually routed between hosts with no previously established communications path.

**Payload Scrambling** - a technique that eliminates certain bit patterns that may occur within an ATM cell payload that could be misinterpreted by certain sensitive transmission equipment as an alarm condition.

**Payload Type (PT)** - bits 2...4 in the fourth byte of an ATM cell header. The PT indicates the type of information carried by the cell. At this time, values 0...3 are used to identify various types of user data, values 4 and 5 indicate management information, and values 6 and 7 are reserved for future use.

**Peak Cell Rate** - at the PHY Layer SAP of a point-to-point VCC, the Peak Cell Rate is the inverse of the minimum inter-arrival time T0 of the request to send an ATM-SDU.

**Peak Cell Rate (PCR)** - parameter defined by the ATM Forum for ATM traffic management. In CBR transmissions, PCR determines how often data samples are sent. In ABR transmissions, PCR determines the maximum value of the ACR.

**Peer Entities** - entities within the same layer.

**Peripheral Component Interconnect (PCI)** - a local-bus standard created by Intel.

**Permanent Virtual Channel Connection (PVCC)** - A Virtual Channel Connection (VCC) is an ATM connection where switching is performed on the VPI/VCI fields of each cell. A Permanent VCC is one which is provisioned through some network management function and left up indefinitely.

**Permanent Virtual Circuit (or Channel) (PVC)** - a circuit or channel through an ATM network provisioned by a carrier between two endpoints; used for dedicated long-term information transport between locations.

**Permanent Virtual Path Connection (PVPC)** - A Virtual Path Connection (VPC) is an ATM connection where switching is performed on the VPI field only of each cell. A PVPC is one which is provisioned through some network management function and left up indefinitely.

**Phase Alternate Line (PAL)** - Largely a German/British development in the late 60s, used in the UK and much of Europe. The B-Y and R-Y signals are weighted to U and V, then modulated onto a double-sideband suppressed subcarrier at 4.43MHz. The V (R-Y) signal's phase is turned through 180 degrees on each alternate line. This gets rid of NTSC's hue changes with phase errors at the expense of de-saturation. The carrier reference is sent as a burst in the back porch. The phase of the burst is alternated every line to convey the phase switching of the V signal. The burst's average phase is -V. (see NTSC for U.S.).

**Physical Layer (PHY)** - the actual cards, wires, and/or fiber-optic cabling used to connect computers, routers, and switches.

**Physical Layer Connection** - an association established by the PHY between two or more ATM-entities. A PHY connection consists of the concatenation of PHY links in order to provide an end-to-end transfer capability to PHY SAPs.

**Physical Layer Convergence Protocol (PLCP)** - a framing protocol that runs on top of the T1 or E1 framing protocol.

**Physical Medium (PM)** - Refers to the actual physical interfaces. Several interfaces are defined including STS-1, STS-3c, STS-12c, STM-1, STM-4, DS1, E1, DS2, E3, DS3, E4, FDDI-based, Fiber Channel-based, and STP. These range in speeds from 1.544Mbps through 622.08 Mbps.

**Physical Medium Dependent (PMD)** - a sublayer concerned with the bit transfer between two network nodes. It deals with wave shapes, timing recovery, line coding, and electro-optic conversions for fiber based links.

**Plesiochronous** - two signals are plesiochronous if their corresponding significant instants occur at nominally the same rate, with variations in rate constrained to specified limits.

**Point of Demarcation** - the dividing line between a carrier and the customer premise that is governed by strict standards that define the characteristics of the equipment on each side of the demarcation. Equipment on one side of the point of demarcation is the responsibility of the customer. Equipment on the other side of the point of demarcation is the responsibility of the carrier.

**Point-to-Multipoint Connection** - a collection of associated ATM VC or VP links, with associated endpoint nodes, with the following properties:

1. One ATM link, called the Root Link, serves as the root in a simple tree topology. When the Root node sends information, all of the remaining nodes on the connection, called Leaf nodes, receive copies of the information.
2. Each of the Leaf Nodes on the connection can send information directly to the Root Node. The Root Node cannot distinguish which Leaf is sending information without additional (higher layer) information. (See the following note for Phase 1.)
3. The Leaf Nodes cannot communicate directly to each other with this connection type.

Note: Phase 1 signalling does not support traffic sent from a Leaf to the Root.

**Point-to-Point Connection** - a connection with only two endpoints.

**Point-to-Point Protocol (PPP)** - Provides a method for transmitting packets over serial point-to-point links.

**Policing** - the function that ensures that a network device does not accept traffic that exceeds the configured bandwidth of a connection.

**Port Identifier** - The identifier assigned by a logical node to represent the point of attachment of a link to that node.

**Presentation Layer** - Sixth layer of the OSI model, providing services to the application layer.

**Primary Reference Source (PRS)** - Equipment that provides a timing signal whose long-term accuracy is maintained at  $1 \times 10^{-11}$  or better with verification to universal coordinated time (UTC) and whose timing signal is used as the basis of reference for the control of other clocks within a network.

**Primitive** - an abstract, implementation-independent interaction between a layer service user and a layer service provider.

**Priority** - the parameter of ATM connections that determines the order in which they are reduced from the peak cell rate to the sustained cell rate in times of congestion. Connections with lower priority (4 is low, 1 is high) are reduced first.

**Private Branch Exchange (PBX)** - a private phone system (switch) that connects to the public telephone network and offers in-house connectivity. To reach an outside line, the user must dial a digit like 8 or 9.

**Private Network Node Interface or Private Network-to-Network Interface (PNNI)** - a protocol that defines the interaction of private ATM switches or groups of private ATM switches

**Programmable Read-Only Memory (PROM)** - a chip-based information storage area that can be recorded by an operator but erased only through a physical process.

**Protocol** - a set of rules and formats (semantic and syntactic) that determines the communication behavior of layer entities in the performance of the layer functions.

**Protocol Control Information** - the information exchanged between corresponding entities using a lower layer connection to coordinate their joint operation.

**Protocol Data Unit (PDU)** - a unit of data specified in a layer protocol and consisting of protocol control information and layer user data.

**Proxy** - the process in which one system acts for another system to answer protocol requests.

**Proxy Agent** - an agent that queries on behalf of the manager, used to monitor objects that are not directly manageable.

**Public Data Network (PDN)** - a network designed primarily for data transmission and intended for sharing by many users from many organizations.

**Pulse Code Modulation (PCM)** - a modulation scheme that samples the information signals and transmits a series of coded pulses to represent the data.

**Q.2931** - Derived from Q.93B, the narrowband ISDN signalling protocol, an ITU standard describing the signalling protocol to be used by switched virtual circuits on ATM LANs.

**Quality of Service (QoS)** - Quality of Service is defined on an end-to-end basis in terms of the following attributes of the end-to-end ATM connection:

- Cell Loss Ratio

- Cell Transfer Delay

- Cell Delay Variation

**Queuing Delay (QD)** - refers to the delay imposed on a cell by its having to be buffered because of unavailability of resources to pass the cell onto the next network function or element. This buffering could be a result of oversubscription of a physical link, or due to a connection of higher priority or tighter service constraints getting the resource of the physical link.

**Radio Frequency Interference (RFI)** - the unintentional transmission of radio signals. Computer equipment and wiring can both generate and receive RFI.

**Real-Time Clock** - a clock that maintains the time of day, in contrast to a clock that is used to time the electrical pulses on a circuit.

**Red Alarm** - In T1, a red alarm is generated for a locally detected failure such as when a condition like OOF exists for 2.5 seconds, causing a CGA, (Carrier Group Alarm).

**Reduced Instruction Set Computer (RISC)** - a generic name for CPUs that use a simpler instruction set than more traditional designs.

**Redundancy** - In a data transmission, the fragments of characters and bits that can be eliminated with no loss of information.

**Registration** - The address registration function is the mechanism by which Clients provide address information to the LAN Emulation Server.

**Relaying** - a function of a layer by means of which a layer entity receives data from a corresponding entity and transmits it to another corresponding entity.

**Request To Send (RTS)** - an RS-232 modem interface signal (sent from the DTE to the modem on pin 4) which indicates that the DTE has data to transmit.

**Requests For Comment (RFCs)** - IETF documents suggesting protocols and policies of the Internet, inviting comments as to the quality and validity of those policies. These comments are collected and analyzed by the IETF in order to finalize Internet standards.

**RFC1483** - Multiprotocol Encapsulation over ATM Adaptation Layer 5.

**RFC1490** - Multiprotocol Interconnect over Frame Relay.

**RFC1577** - Classical IP and ARP over ATM.

**RFC1755** - ATM Signaling Support for IP over ATM.

**Robbed-Bit Signaling** - In T1, refers to the use of the least significant bit of every word of frames 6 and 12 (D4), or 6, 12, 18, and 24 (ESF) for signaling purposes.

**Route Server** - A physical device that runs one or more network layer routing protocols, and which uses a route query protocol in order to provide network layer routing forwarding descriptions to clients.

**Router** - a device that forwards traffic between networks or subnetworks based on network layer information.

**Routing Domain (RD)** - A group of topologically contiguous systems which are running one instance of routing.

**Routing Information Protocol (RIP)** - a distance vector-based protocol that provides a measure of distance, or hops, from a transmitting workstation to a receiving workstation.

**Routing Protocol** - A general term indicating a protocol run between routers and/or route servers in order to exchange information used to allow computation of routes. The result of the routing computation will be one or more forwarding descriptions.

**SBus** - hardware interface for add-in boards in later-version Sun 3 workstations.

**Scalable Processor Architecture Reduced instruction set Computer (SPARC)** - a powerful workstation similar to a reduced-instruction-set-computing (RISC) workstation.

**Segment** - a single ATM link or group of interconnected ATM links of an ATM connection.

**Segmentation And Reassembly (SAR)** - the SAR accepts PDUs from the CS and divides them into very small segments (44 bytes long). If the CS-PDU is less than 44 bytes, it is padded to 44 with zeroes. A two-byte header and trailer are added to this basic segment. The header identifies the message type (beginning, end, continuation, or single) and contains sequence numbering and message identification. The trailer gives the SAR-PDU payload length, exclusive of pad, and contains a CRC check to ensure the SAR-PDU integrity. The result is a 48-byte PDU that fits into the payload field of an ATM cell.

**Selector (SEL)** - A subfield carried in SETUP message part of ATM endpoint address Domain specific Part (DSP) defined by ISO 10589, not used for ATM network routing, used by ATM end systems only.

**Semipermanent Connection** - a connection established via a service order or via network management.

**Serial Line IP (SLIP)** - A protocol used to run IP over serial lines, such as telephone circuits or RS-232 cables, interconnecting two systems.

**Service Access Point (SAP)** - the point at which an entity of a layer provides services to its LM entity or to an entity of the next higher layer.

**Service Data Unit (SDU)** - a unit of interface information whose identity is preserved from one end of a layer connection to the other.

**Service Specific Connection Oriented Protocol (SSCOP)** - an adaptation layer protocol defined in ITU-T Specification: Q.2110.

**Service Specific Convergence Sublayer (SSCS)** - The portion of the convergence sublayer that is dependent upon the type of traffic that is being converted.

**Session Layer** - Layer 5 in the OSI model that is responsible for establishing and managing sessions between the application programs running in different nodes.

**Severely Errored Seconds (SES)** - a second during which more event errors have occurred than the SES threshold (normally 10-3).

**Shaping Descriptor** -  $n$  ordered pairs of GCRA parameters (I,L) used to define the negotiated traffic shape of an APP connection. The traffic shape refers to the load-balancing of a network, where load-balancing means configuring data flows to maximize network efficiency.

**Shielded Pair** - Two insulated wires in a cable wrapped with metallic braid or foil to prevent interference and provide noise free transmission.

**Shielded Twisted Pair (STP)** - two or more insulated wires, twisted together and then wrapped in a cable with metallic braid or foil to prevent interference and offer noise-free transmissions.

**Signaling System No. 7 (SS7)** - The SS7 protocol has been specified by ITU-T and is a protocol for interexchange signaling.

**Simple and Efficient Adaptation Layer (SEAL)** - also called AAL 5, this ATM adaptation layer assumes that higher layer processes will provide error recovery, thereby simplifying the SAR portion of the adaptation layer. Using this AAL type packs all 48 bytes of an ATM cell information field with data. It also assumes that only one message is crossing the UNI at a time. That is, multiple end-users at one location cannot interleave messages on the same VC, but must queue them for sequential transmission.

**Simple Gateway Management Protocol (SGMP)** - the predecessor to SNMP.

**Simple Mail Transfer Protocol (SMTP)** - the Internet electronic mail protocol used to transfer electronic mail between hosts.

**Simple Network Management Protocol (SNMP)** - the Internet standard protocol for managing nodes on an IP network.

**Simple Protocol for ATM Network Signalling (SPANS)** - FORE Systems' proprietary signalling protocol used for establishing SVCs between FORE Systems equipment.

**Single Mode Fiber (SMF)** - Fiber optic cable in which the signal or light propagates in a single mode or path. Since all light follows the same path or travels the same distance, a transmitted pulse is not dispersed and does not interfere with adjacent pulses. SMF fibers can support longer distances and are limited mainly by the amount of attenuation. Refer to MMF.

**Small Computer Systems Interface (SCSI)** - a standard for a controller bus that connects hardware devices to their controllers on a computer bus, typically used in small systems.

**Smart PVC (SPVC)** - a generic term for any communications medium which is permanently provisioned at the end points, but switched in the middle. In ATM, there are two kinds of SPVCs: smart permanent virtual path connections (SPVPCs) and smart permanent virtual channel connections (SPVCCs).

**snmpd** - an SNMP agent for a given adapter card.

**Source** - Part of communications system which transmits information.

**Source Address (SA)** - The address from which the message or data originated.

**Source MAC Address (SA)** - A six octet value uniquely identifying an end point and which is sent in an IEEE LAN frame header to indicate source of frame.

**Source Traffic Descriptor** - a set of traffic parameters belonging to the ATM Traffic Descriptor used during the connection set-up to capture the intrinsic traffic characteristics of the connection requested by the source.

**Spanning Tree Protocol** - provides loop-free topology in a network environment where there are redundant paths.

**Static Route** - a route that is entered manually into the routing table.

**Statistical Multiplexing** - a technique for allowing multiple channels and paths to share the same link, typified by the ability to give the bandwidth of a temporarily idle channel to another channel.

**Stick and Click (SC)** - Designation for an Optical Connector featuring a 2.5 mm physically contacting ferrule with a push-pull mating design. Commonly referred to as Structured Cabling, Structured Connectors or Stick and Click

**Stick and Turn (ST)** - A fiber-optic connector designed by AT&T which uses the bayonet style coupling rather than screw-on as the SMA uses. The ST is generally considered the eventual replacement for the SMA type connector.

**Store-and-Forward** - the technique of receiving a message, storing it until the proper outgoing line is available, then retransmitting it, with no direct connection between incoming and outgoing lines.

**Straight Tip (ST)** - see *Stick and Turn*.

**Structured Cabling (SC)** - see *Stick and Click*.

**Structured Connectors (SC)** - see *Stick and Click*.

**Sublayer** - a logical subdivision of a layer.

**SubNetwork Access Protocol (SNAP)** - a specially reserved variant of IEEE 802.2 encoding SNAP indicates to look further into the packet where it will find a Type field.

**Subscriber Network Interface (SNI)** - the interface between an SMDS end user's CPE and the network directly serving the end user, supported by either a DS1 or DS3 access arrangement.

**Super Frame (SF)** - a term used to describe the repeating 12 D4 frame format that composes a standard (non-ESF) T1 service.

**Super User** - a login ID that allows unlimited access to the full range of a device's functionality, including especially the ability to reconfigure the device and set passwords.

**Sustainable Cell Rate (SCR)** - ATM Forum parameter defined for traffic management. For VBR connections, SCR determines the long-term average cell rate that can be transmitted.

**Sustained Information Rate (SIR)** - In ATM this refers to the long-term average data transmission rate across the User-to-Network Interface. In SMDS this refers to the committed information rate (similar to CIR for Frame Relay Service).

**Switch** - Equipment used to interconnect lines and trunks.

**Switched Connection** - A connection established via signaling.

**Switched Multimegabit Data Service (SMDS)** - a high-speed, datagram-based, public data network service expected to be widely used by telephone companies in their data networks.

**Switched Virtual Channel Connection (SVCC)** - A Switched VCC is one which is established and taken down dynamically through control signaling. A Virtual Channel Connection (VCC) is an ATM connection where switching is performed on the VPI/VCI fields of each cell.

**Switched Virtual Circuit (or Channel) (SVC)** - a channel established on demand by network signalling, used for information transport between two locations and lasting only for the duration of the transfer; the datacom equivalent of a dialed telephone call.

**Switched Virtual Path Connection (SVPC)** - a connection which is established and taken down dynamically through control signaling. A Virtual Path Connection (VPC) is an ATM connection where switching is performed on the VPI field only of each cell.

**Switching System** - A set of one or more systems that act together and appear as a single switch for the purposes of PNNI routing.

**Symmetric Connection** - a connection with the same bandwidth specified for both directions.

**Synchronous** - signals that are sourced from the same timing reference and hence are identical in frequency.

**Synchronous Data Link Control (SDLC)** - IBM's data link protocol used in SNA networks.

**Synchronous Optical Network (SONET)** - a body of standards that defines all aspects of transporting and managing digital traffic over optical facilities in the public network.

**Synchronous Payload Envelope (SPE)** - the payload field plus a little overhead of a basic SONET signal.

**Synchronous Transfer Mode (STM)** - a transport and switching method that depends on information occurring in regular, fixed patterns with respect to a reference such as a frame pattern.

**Synchronous Transport Signal (STS)** - a SONET electrical signal rate.

**Système En Couleur Avec Mémoire (SECAM) - Sequential and Memory Color Television** - Started in France in the late 60s, and used by other countries with a political affiliation. This is. The B-Y and R-Y signals are transmitted on alternate lines modulated on an FM subcarrier. The memory is a one line delay line in the receiver to make both color difference signals available at the same time on all lines. Due to FM, the signal is robust in difficult terrain.

**Systems Network Architecture (SNA)** - a proprietary networking architecture used by IBM and IBM-compatible mainframe computers.

**T1** - a specification for a transmission line. The specification details the input and output characteristics and the bandwidth. T1 lines run at 1.544 Mbps and provide for 24 data channels. In common usage, the term "T1" is used interchangeably with "DS1."

**T1 Link** - A wideband digital carrier facility used for transmission of digitized voice, digital data, and digitized image traffic. This link is composed of two twisted-wire pairs that can carry 24 digital channels, each operating at 64K bps at the aggregate rate of 1.544M bps, full duplex. Also referred to as DS-1.

**T3** - a specification for a transmission line, the equivalent of 28 T1 lines. T3 lines run at 44.736 Mbps. In common usage, the term "T3" is used interchangeably with "DS3."

**Tachometer** - in *ForeView*, the tachometer shows the level of activity on a given port. The number in the tachometer shows the value of a chosen parameter in percentage, with a colored bar providing a semi-logarithmic representation of that percentage.

**Tagged Cell Rate (TCR)** - An ABR service parameter, TCR limits the rate at which a source may send out-of-rate forward RM-cells. TCR is a constant fixed at 10 cells/second.

**Telephony** - The conversion of voices and other sounds into electrical signals which are then transmitted by telecommunications media.

**Telnet** - a TCP/IP protocol that defines a client/server mechanism for emulating directly-connected terminal connections.

**Terminal Equipment (TE)** - Terminal equipment represents the endpoint of ATM connection(s) and termination of the various protocols within the connection(s).

**Throughput** - Measurement of the total useful information processed or communicated by a computer during a specified time period, i.e. packets per second.

**Time Division Multiplexing (TDM)** - a method of traditional digital multiplexing in which a signal occupies a fixed, repetitive time slot within a higher-rate signal.

**Token Ring** - a network access method in which the stations circulate a token. Stations with data to send must have the token to transmit their data.

**topology** - a program that displays the topology of a FORE Systems ATM network. An updated topology can be periodically re-displayed by use of the interval command option.

**Traffic** - the calls being sent and received over a communications network. Also, the packets that are sent on a data network.

**Traffic Management (TM)** - The traffic control and congestion control procedures for ATM. ATM layer traffic control refers to the set of actions taken by the network to avoid congestion conditions. ATM layer congestion control refers to the set of actions taken by the network to minimize the intensity, spread and duration of congestion. The following functions form a framework for managing and controlling traffic and congestion in ATM networks and may be used in appropriate combinations:

- Connection Admission Control
- Feedback Control
- Usage Parameter Control
- Priority Control
- Traffic Shaping
- Network Resource Management
- Frame Discard
- ABR Flow Control

**Traffic Parameter** - A parameter for specifying a particular traffic aspect of a connection.

**Trailer** - the protocol control information located at the end of a PDU.

**Transit Delay** - the time difference between the instant at which the first bit of a PDU crosses one designated boundary, and the instant at which the last bit of the same PDU crosses a second designated boundary.

**Transmission Control Protocol (TCP)** - a specification for software that bundles and unbundles sent and received data into packets, manages the transmission of packets on a network, and checks for errors.

**Transmission Control Protocol/Internet Protocol (TCP/IP)** - a set of communications protocols that has evolved since the late 1970s, when it was first developed by the Department of Defense. Because programs supporting these protocols are available on so many different computer systems, they have become an excellent way to connect different types of computers over networks.

**Transmission Convergence (TC)** - generates and receives transmission frames and is responsible for all overhead associated with the transmission frame. The TC sublayer packages cells into the transmission frame.

**Transmission Convergence Sublayer (TCS)** - This is part of the ATM physical layer that defines how cells will be transmitted by the actual physical layer.

**Transparent Asynchronous Transmitter/Receiver Interface (TAXI)** - Encoding scheme used for FDDI LANs as well as for ATM; supports speed typical of 100 Mbps over multimode fiber.

**Transport Layer** - Layer Four of the OSI reference model that is responsible for maintaining reliable end-to-end communications across the network.

**trap** - a program interrupt mechanism that automatically updates the state of the network to remote network management hosts. The SNMP agent on the switch supports these SNMP traps.

**Trivial File Transfer Protocol (TFTP)** - Part of IP, a simplified version of FTP that allows files to be transferred from one computer to another over a network.

**Twisted Pair** - Insulated wire in which pairs are twisted together. Commonly used for telephone connections, and LANs because it is inexpensive.

**Unassigned Cells** - a generated cell identified by a standardized virtual path identifier (VPI) and virtual channel identifier (VCI) value, which does not carry information from an application using the ATM Layer service.

**Unavailable Seconds (UAS)** - a measurement of signal quality. Unavailable seconds start accruing when ten consecutive severely errored seconds occur.

**UNI 3.0/3.1** - the User-to-Network Interface standard set forth by the ATM Forum that defines how private customer premise equipment interacts with private ATM switches.

**Unicasting** - The transmit operation of a single PDU by a source interface where the PDU reaches a single destination.

**Universal Test & Operations Interface for ATM (UTOPIA)** - Refers to an electrical interface between the TC and PMD sublayers of the PHY layer.

**Unshielded Twisted Pair (UTP)** - a cable that consists of two or more insulated conductors in which each pair of conductors are twisted around each other. There is no external protection and noise resistance comes solely from the twists.

**Unspecified Bit Rate (UBR)** - a type of traffic that is not considered time-critical (e.g., ARP messages, pure data), allocated whatever bandwidth is available at any given time. UBR traffic is given a “best effort” priority in an ATM network with no guarantee of successful transmission.

**Uplink** - Represents the connectivity from a border node to an upnode.

**Usage Parameter Control (UPC)** - mechanism that ensures that traffic on a given connection does not exceed the contracted bandwidth of the connection, responsible for policing or enforcement. UPC is sometimes confused with congestion management (see *congestion management*).

**User Datagram Protocol (UDP)** - the TCP/IP transaction protocol used for applications such as remote network management and name-service access; this lets users assign a name, such as “RVAX\*2,S,” to a physical or numbered address.

**User-to-Network Interface (UNI)** - the physical and electrical demarcation point between the user and the public network service provider.

**V.35** - ITU-T standard describing a synchronous, physical layer protocol used for communications between a network access device and a packet network. V.35 is most commonly used in the United States and Europe, and is recommended for speeds up to 48 Kbps.

**Variable Bit Rate (VBR)** - a type of traffic that, when sent over a network, is tolerant of delays and changes in the amount of bandwidth it is allocated (e.g., data applications).

**Virtual Channel (or Circuit) (VC)** - a communications path between two nodes identified by label rather than fixed physical path.

**Virtual Channel Connection (VCC)** - a unidirectional concatenation of VCLs that extends between the points where the ATM service users access the ATM Layer. The points at which the ATM cell payload is passed to, or received from, the users of the ATM Layer (i.e., a higher layer or ATMM-entity) for processing signify the endpoints of a VCC.

**Virtual Channel Identifier (VCI)** - the address or label of a VC; a value stored in a field in the ATM cell header that identifies an individual virtual channel to which the cell belongs. VCI values may be different for each data link hop of an ATM virtual connection.

**Virtual Channel Link (VCL)** - a means of unidirectional transport of ATM cells between the point where a VCI value is assigned and the point where that value is translated or removed.

**Virtual Channel Switch** - a network element that connects VCLs. It terminates VPCs and translates VCI values. The Virtual Channel Switch is directed by Control Plane functions and relays the cells of a VC.

**Virtual Connection** - an endpoint-to-endpoint connection in an ATM network. A virtual connection can be either a virtual path or a virtual channel.

**Virtual Local Area Network (VLAN)** - Work stations connected to an intelligent device which provides the capabilities to define LAN membership.

**Virtual Network Software (VINES)** - Banyan's network operating system based on UNIX and its protocols.

**Virtual Path (VP)** - a unidirectional logical association or bundle of VCs.

**Virtual Path Connection (VPC)** - a concatenation of VPLs between virtual path terminators (VPTs). VPCs are unidirectional.

**Virtual Path Identifier (VPI)** - the address or label of a particular VP; a value stored in a field in the ATM cell header that identifies an individual virtual path to which the cell belongs. A virtual path may comprise multiple virtual channels.

**Virtual Path Link (VPL)** - a means of unidirectional transport of ATM cells between the point where a VPI value is assigned and the point where that value is translated or removed.

**Virtual Path Switch** - a network element that connects VPLs, it translates VPI (not VCI) values and is directed by Control Plane functions. The Virtual Path Switch relays the cells of a Virtual Path.

**Virtual Path Terminator (VPT)** - a system that unbundles the VCs of a VP for independent processing of each VC.

**Virtual Private Data Network (VPDN)** - a private data communications network built on public switching and transport facilities rather than dedicated leased facilities such as T1s.

**Virtual Private Network (VPN)** - a private voice communications network built on public switching and transport facilities rather than dedicated leased facilities such as T1s.

**Virtual Source/Virtual Destination (VS/VD)** - An ABR connection may be divided into two or more separately controlled ABR segments. Each ABR control segment, except the first, is sourced by a virtual source. A virtual source implements the behavior of an ABR source endpoint. Backwards RM-cells received by a virtual source are removed from the connection. Each ABR control segment, except the last, is terminated by a virtual destination. A virtual destination assumes the behavior of an ABR destination endpoint. Forward RM-cells received by a virtual destination are turned around and not forwarded to the next segment of the connection.

**Virtual Tributary (VT)** - a structure used to carry payloads such as DS1s that run at significantly lower rates than STS-1s.

**Warm Start Trap** - an SNMP trap which indicates that SNMP alarm messages or agents have been enabled.

**Wide-Area Network (WAN)** - a network that covers a large geographic area.

**Wideband Channel** - Communications channel with more capacity (19.2K bps) than the standard capacity of a voice grade line.

**X.21** - ITU-T standard for serial communications over synchronous digital lines. The X.21 protocol is used primarily in Europe and Japan.

**X.25** - a well-established data switching and transport method that relies on a significant amount of processing to ensure reliable transport over metallic media.

**Yellow Alarm** - An alarm signal sent back toward the source of a failed signal due to the presence of an AIS (may be used by APS equipment to initiate switching).

**Zero Byte Time Slot Interchange (ZBTSl)** - A technique used with the T carrier extended super-frame format (ESF) in which an area in the ESF frame carries information about the location of all-zero bytes (eight consecutive "0"s) within the data stream.

**Zero Code Suppression** - The insertion of a "1" bit to prevent the transmission of eight or more consecutive "0" bits. Used primarily with T1 and related digital telephone company facilities, which require a minimum "1's density" in order to keep the individual subchannels of a multiplexed, high speed facility active.

**Zero-Bit Insertion** - A technique used to achieve transparency in bit-oriented protocols. A zero is inserted into sequences of one bits that cause false flag direction.



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